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High Ratios of Expansion and Distribution of Unequal Pressures in Single and Compound Engines.

BY J. C. HOADLEY, C. E.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Although my ultimate theme, as will appear later, is the compound engine, the first part of my remarks may seem to be almost irrelevant, so elementary is the mode of elucidation which I propose to adopt, and for which I have prepared numerous diagrams, although circumstances have not afforded me the time necessary to write out my ideas as embodied in the drawings. It has seemed to me that the considerations, hitherto taken into account in making comparisons between the performance of compound engines and that of single cylinders, fail to explain in a satisfactory manner the considerable advantage which generally appears in favor of the former, notwithstanding the obvious increase of frictional resistance caused by the introduction of the second cylinder, and the loss by expansion between the cylinders without doing work. That such a preponderance of advantage generally appears will, I think, be admitted, although in a few instances single cylinders have closely rivaled the best performance of compound engines.

Why is it, then, that the production of power by the transformation of the molecular motion of heat into the kinetic energy of moving masses, through the expansive force of steam in a steam engine, can be more economically conducted in two cylinders than in one, the ratio of expansion being the same? Dividing the fall of temperature between the boiler and condenser is, doubtless, analogous to the introduction of a separate condenser. Interposing an intermediate temperature of 200° F. between the 300° of the boiler and the 100° of the condenser, serves as a "heat trap" to keep the low temperature of the condenser away from the surfaces which have to come into contact with high-pressure steam. This is a true cause, effective as far as it goes, but falls short, as it seems to me, of fully accounting for the observed facts. There is another cause, unnoticed hitherto, so far as I know, although vaguely hinted at under the general terms of "better distribution of pressure," which seems to me to exert no little influence, and to deserve more attention than has been bestowed upon it hitherto. In order to make my meaning perfectly clear, I will go rapidly over the diagrams here exhibited, and explain the transformations they undergo, and the influence of these transformations upon the useful effect of the horizontal pressure on the piston of a horizontal engine.

FIG. III.

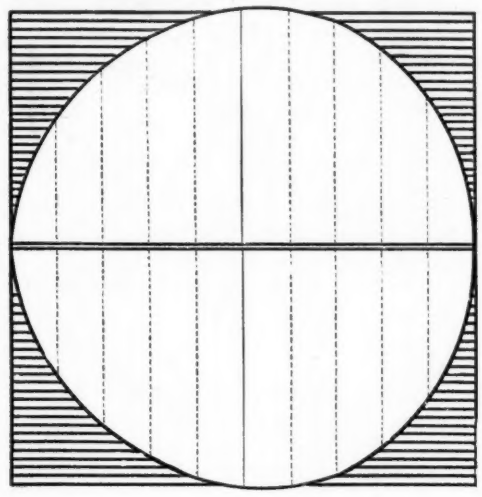


Fig. 1.—Let the horizontal medial line $S\,S$, represent the stroke of a piston, and let the circle described about its middle point represent the orbit of the crank. Let the height $S\,A\,S'\,B$, from this medial line to the top of the figure represent, on any scale whatever, uniform effective piston pressure throughout the stroke, and the minor axis, half the length of the major axis, will represent the stroke of the piston.

Then will the area of this ellipse represent, on the scale of pressure adopted, the rotative effect, or the tangential component of the horizontal pressure, equal to zero at the beginning and end of the stroke, and to unity at mid-stroke, and the ratio of this area to the area of the parallelogram will equal the ratio of the rotative effect to piston pressure, namely, the ratio of $\frac{\pi}{4}$ to unity, or about 78.5 per cent. Supposing, now, this circle to be revolved upon the medial line as an axis, through one-fourth of a revolution, until its plane is perpendicular to the plane of the paper, and the ordinances of the ellipse exterior to the circle to be erected upon the medial line. We shall then have our ellipse reduced to a circle, and our parallelogram to a square.

FIG. I.

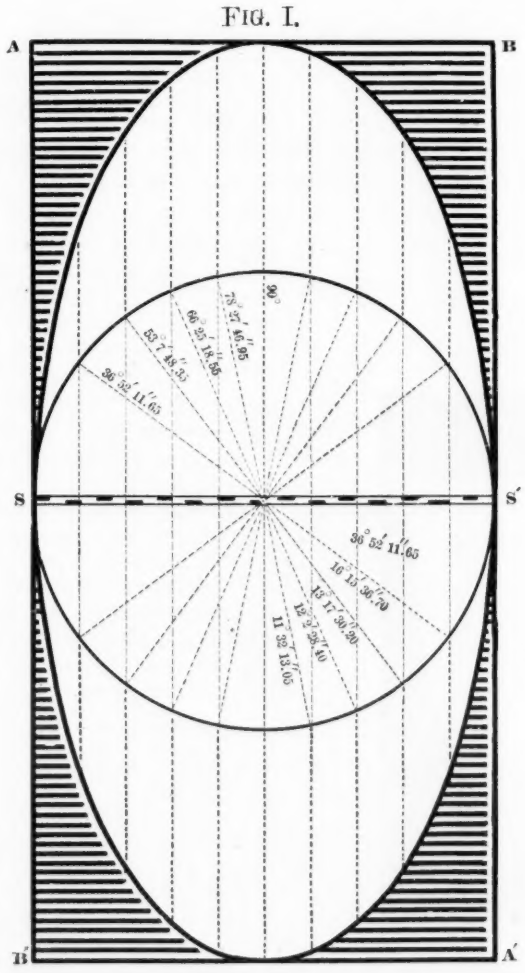


FIG. II.

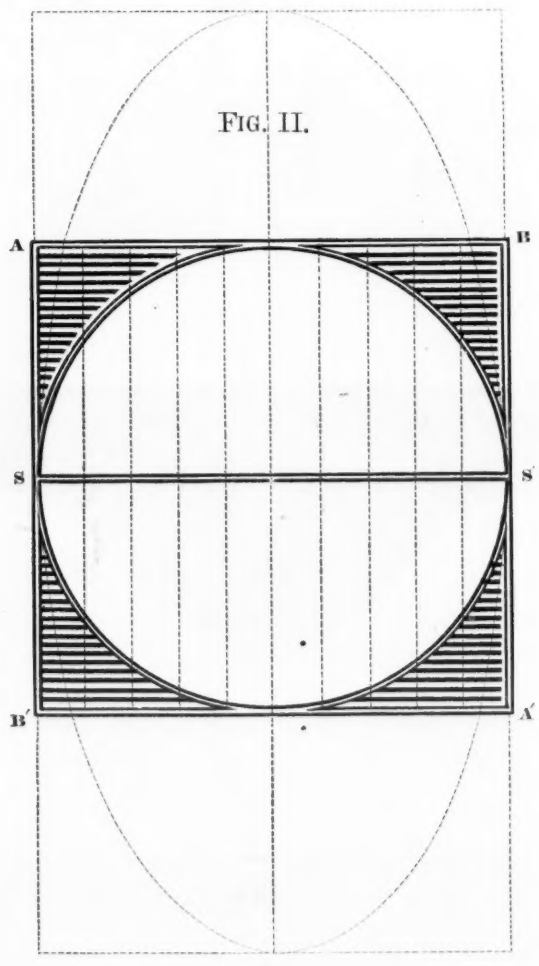


FIG. IV.

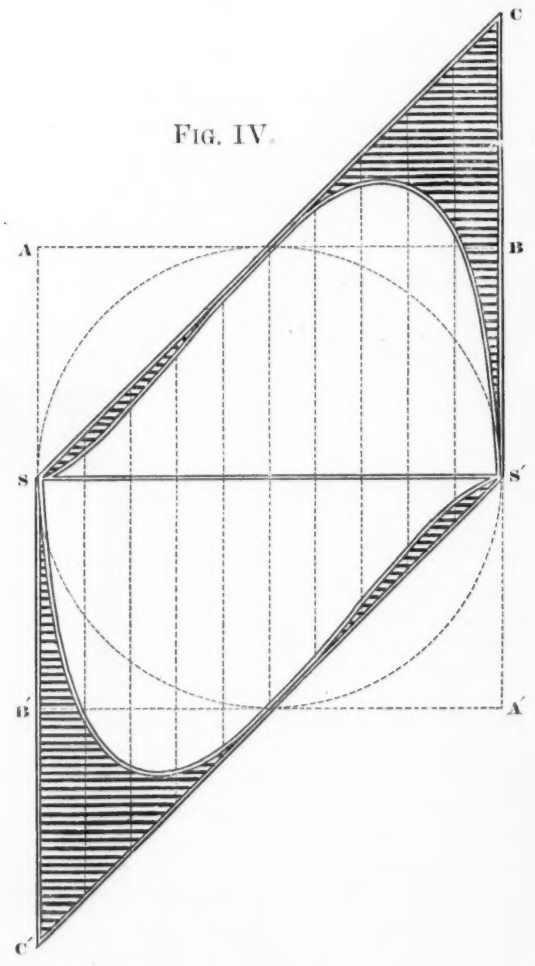


Fig. 2. One rotative effect is now represented by a circle, and the piston pressure of an entire revolution, by a circumscribing square to this circle; and the ratio of rotative effect to piston pressure as before $\frac{\pi}{4}$ to unity.

Fig. 3. We have hitherto neglected the influence of the angular vibration of the connecting rod, as if it remained constantly parallel to the axis of the engine. We see in this figure, resembling somewhat the horizontal section of a human skull, the effect of a connecting rod of a length five and one-third times the length of the crank. The area representing the rotative effect is no longer a circular area, and although symmet-

rical on each side of the medial line, it is no longer so if divided vertically by the middle ordinary, since more rotative effect appears to be developed in the portion towards S', to the right of the middle ordinate, which represents the end of the cylinder farthest from the crank, than in the other end. This inequality results from the unequal velocity of the piston near the two ends of the stroke, which, in turn, is caused by the angular vibration of the connecting rod.

But the whole area of this unsymmetrical figure is equal to the arc of the circle in Fig. 2, and notwithstanding that the curve transcends the square of mid-stroke, the ratio of this area to the square, representing piston pressure, remains as $\frac{\pi}{4}$ to unity as at first.

Fig. 4. We here see the effect of the inertia of the reciprocating parts in modifying the horizontal pressure upon the crank pin. Still supposing the piston pressure to be uniform, and equal on any scale whatever, to the radius of our circle, and assuming that the weight and velocity of the reciprocating parts are such that their inertia is just equal at dead center to the piston pressure, one square of piston pressure is transformed at the crank pin into a lozenge, *SOS'O'*, of area equal to the square; one circle of rotative effect is transformed into the curvilineate figure here seen, symmetrical as divided by the line of stroke, and still bearing the ratio to the lozenge of $\frac{\pi}{4}$ to unity, since every ordinate bears the same ratio to the whole height of the lozenge at its position, that the line at the same position bears to radius or unity.

Fig. 5. We here see a further modification of the areas under consideration, by the vibratory motion of the connecting rod. The top and bottom lines are no longer straight, but are curves of peculiar character—alike, but disturbing the symmetry of our areas, to preserve which one of the lines would have to be reversed. But the shaded figure *SACS'CS*, is equal to the square of Fig. 2 and to the lozenge of Fig. 4; the area of rotative effect is still equal to that of the circle of Fig. 2, and their ratio still remains as $\frac{\pi}{4}$ to unity, notwithstanding that the curves of rotative effect transcends, at and near mid-stroke, the lines of horizontal pressure on crank pin.

Fig. 6. I now introduce a very ordinary pair of indicator diagrams, just such as any ordinary locomotive or other link-motion engine will produce any day when in good order and working with 2½ fold expansion. The black space which serves as a background is bounded at the bottom by the vacuum line, at the top by the line of boiler pressure, and at the ends by lines representing clearance in terms of stroke.

These diagrams show the effect of wire-drawing on the admission line—of early release, corresponding to compression, upon the expansion line, and of compression up to initial pressure, upon the exhaust line. So ordinary are they, that some master mechanics might be tempted to adopt the vernacular, and style them "'ornery." But such as they are, just such diagrams as these have to do the greater part of the steam engine duty of the world. Let us, then, see what they are doing, and can do. A scale of pressures is here introduced for the first time, namely, 50 pounds per square inch to one inch in height. Boiler pressure is 130 pounds above atmosphere, say 144.7 absolute; initial pressure is 105 pounds above the atmosphere, say 119.7 absolute, and back pressure up to closure of exhaust, 16 pounds absolute; and including compression, 17.91 pounds absolute. Cut-off takes place at 30 per cent. of stroke from clearance line, or at about 28 per cent. of stroke from dead center, the absolute ratio of expansion is 3.3,—mid-stroke pressure is 50 lbs. above back pressure, terminal pressure,—expansion supposed to be continued to the end,—36.11 pounds, and mean effective pressure in the cylinder, all deductions made for wire-drawing and early exhaust, 52.25 pounds.

Fig. 7. The diagrams shown in the preceding figure, are here seen enlarged vertically to a scale of 20 pounds per square inch to one inch of vertical height, or 2½ times, so that mid-stroke pressure is now equal to the radius of our circle. The forward and return stroke diagrams are placed base to base, their common base-line being their respective lines of back pressure, 16 lbs. above vacuum line. Compression is indicated by heavy shading.

We have here, we see at a glance, pretty nearly our lozenge of Fig. 4, as indicated by the dotted lines *CS'*, *C'S*; but reversed, the highest pressure being at the beginning of each stroke.

It will be observed, however, that the figure formed by the two diagrams is a little larger than the lozenge. This is because compression is not only a deficiency to be made up, but also a resistance to be overcome. Let us now see what effect will be produced upon this approximate lozenge by the causes which so greatly modified our square of uniform pressure, and our circle of rotative effect.

Fig. 8, exhibits all the lines shown on the five succeeding figures, and the auxiliary lines used in tracing them, introduced for reference, but not requiring special comment.

Fig. 9. Here is seen the effect of the inertia of the reciprocating parts,—reproducing very nearly our original square of uniform piston pressure; that is, the same cause which transformed one square to a lozenge, now re-transforms our approximate reversed lozenge back to almost a square.

It is a little larger than the square, for the reason already explained, namely, to compensate for the resistance of compression, which is indicated by the dark shading.

Fig. 10. The rotative effect on the crank-pin, in a tangential direction, is seen in this figure, in direct comparison with the square of uniform horizontal pressure *A B A' B'*, darkly shaded around it, save where portions of it project beyond. In the next figure,

Fig. 11. This same rotative effect is shown in direct comparison with the circle of rotative effect due to uniform pressure, horizontally, upon the crank pin. By comparing this figure with the last, it will be seen that the rotative effect produced by the varying piston pressure of these diagrams, is more nearly uniform than would be the corresponding effect of equal, mean, effective pressure uniformly exerted upon the piston throughout the entire revolution.

(To be Continued.)

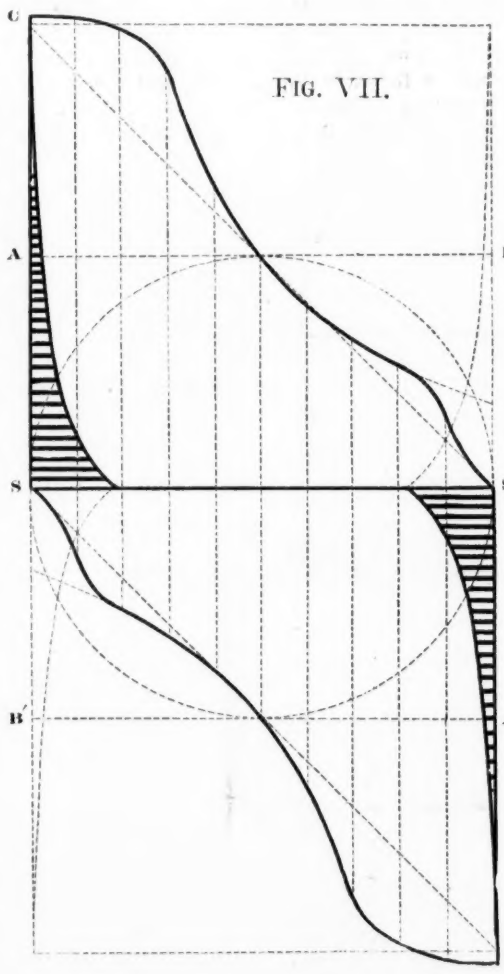


FIG. VII.

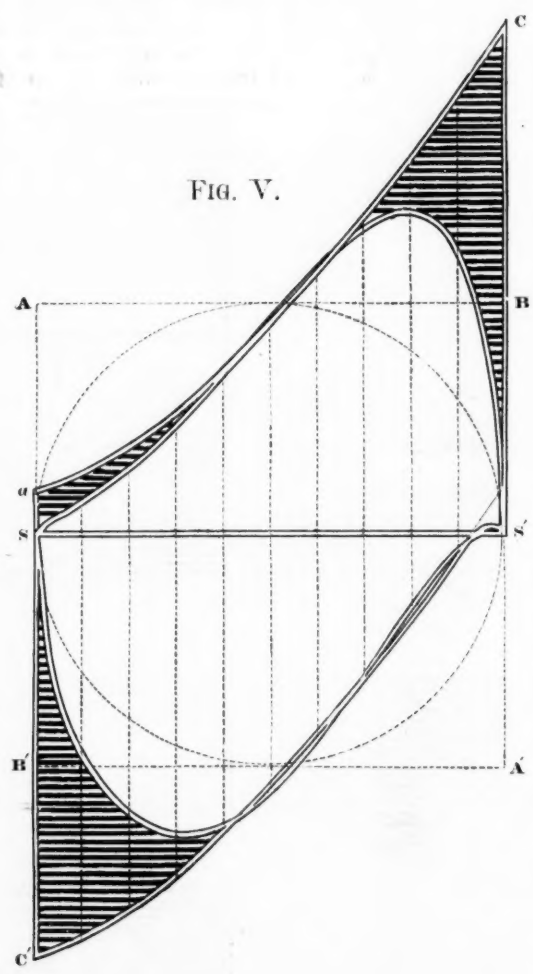
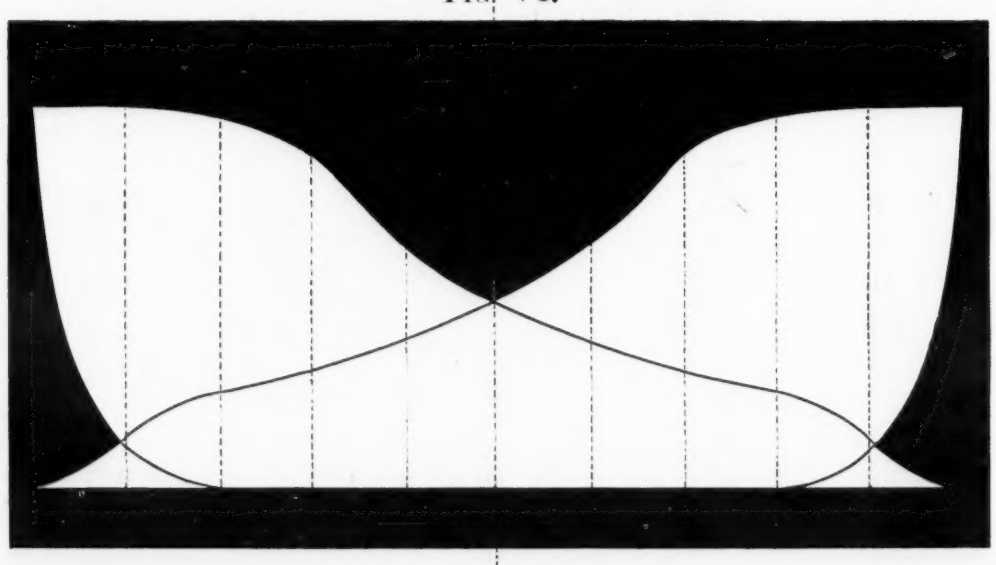


FIG. V.

FIG. VI.



The New England Cotton Manufacturers' Association recently held a meeting in Boston, at which much valuable information for the good of the trade was exchanged.

The Corliss Centennial engine (1,400 H.P.), is rapidly being placed in position at the Pullman Works at Chicago. It is expected that it will be in working order by Dec. 30.

The twenty-eighth annual meeting of the American Society of Civil Engineers was held lately in this city, at which a number of interesting and valuable papers were read.

The Ohio and Western Railroad Company has been incorporated to build a railroad from Columbus, O., west to the Indiana line, there to connect with the new road of the Indiana and Eastern Company.

The statement sometimes made in England that the rapid production in America impairs quality of product is but a cover for inadequate plant. Steel is obviously no better because five hours instead of one are consumed in setting a vessel bottom, or because it may take twice as long in an English works to handle materials and product.—*A. L. Holley.*

A movement is being pushed to consolidate the Union, Central and Southern Pacific Railroads.

The agriculturists of the United States find a ready market at home among the non-producers of their products for about six-tenths of all they produce; about one-tenth goes abroad, and they themselves consume the other three-tenths.

The cotton seed oil mills in St. Louis, are receiving constant supplies of raw material, and are kept constantly busy manufacturing oil. The supply of seed being unusually large and the demand for the products, oil and cake, brisk, the industry promises to be very remunerative during the current year.

M. De Lesseps states that the opening of the Suez Canal has increased the rainfall in the surrounding country to a remarkable extent. Previous to 1870, rain fell only about once a year, while now it falls at least twice a month.

The *Shoe and Leather Reporter*, in a recent editorial, calls for the establishment in this country of a series of technical schools like those in France, for the education of working mechanics.

A company with large capital has been formed in Paris to work up an invention for coating thread with silk. The invention embraces, according to the "Bulletin des Soies," a chemical process for covering linen or other vegetable threads with a mesh of silken matter in a manner similar to that in which metallic objects are plated with gold or silver. The process is dependent on the fact, which has long been known, that silk is soluble in several strong acid preparations.

The American Institute Fair in this city closed Nov. 27th, after being open over two months. The number of visitors was very large, and much interest was manifested in the exhibits.

The Boot and Shoe Manufacturers' Association, of the United States, recently held an interesting meeting in Philadelphia, which was attended by over 500 members of the trade.

Grinding and Polishing Metal Surfaces by Hand.

BY THOS. F. HAGERTY, M. E.

(REPUBLISHED BY REQUEST OF MANY READERS FROM OUR ISSUE OF DECEMBER, 1878.)

There is no job the worker in metal is called on to do that requires the exercise of his brain and muscle, in the proper direction, more than the grinding and polishing of metal surfaces on that class of work where machinery cannot aid him. The more he exercises his brain, the more saving he will be of both his time and muscle. The practice generally employed by machinists in grinding and polishing either new or old work was to mix the polishing material with oil, usually refuse machinery oil; in most cases this is a great mistake, and has caused the loss of time, patience and money. Take, for instance, the grinding to a true bearing of a stop cock, a valve seat, or a slide valve. There are few machinists but what have had more or less of that class of work to do, particularly in jobbing shops, and we seldom find one who uses the same method of accomplishing the job that is practiced in shops where that class of work is made a specialty. In fitting and grinding in the plug into the barrel of a cock a little judgment and care will save a great deal of hard labor, and in no case should oil be mixed with any of the grinding material, for the following reasons: If fine emery, ground glass or sand are used with oil, it requires but a few turns of the plug in the barrel to break up the grains of the grinding material into very fine particles; the metal surfaces also grind off, the fine particles of metal mixing in with the grinding material and oil, making a thick paste of the mass. At this stage it is impossible to grind or bring the metal surfaces to a bearing, as the gluey paste keeps the metal apart; if more grinding stuff is applied it will prevent the operator from seeing what part of the barrel and plug bears the hardest. Again, if the grinding material be distributed over the whole surface, the parts that do not bear will grind off as fast as the parts that touch hard, as the particles work freely between the surfaces: should the barrel and plug bear equally all over when fitted, it requires more care than if it were a top or bottom bearing, as that part of the barrel and plug across the "waterway" grinds twice as fast as the other parts, therefore, it should be kept the dryest. Now this objection holds good in the grinding of valve seats or slide valves, to wit: the separation of the surfaces of the metal by a thick, pasty grinding material. In order to bring the surfaces to a perfect bearing rapidly and with little labor, the following directions will be found worth a trial:

To grind a stop cock of any kind, first see that the plug fits the barrel before it is taken from the lathe. Run a half-round smooth file up and down the barrel to break any rings that may be in it; a few rubs of a smooth file back and forth over the plug will break any rings or tool marks on it. Wipe both parts clean. Use for grinding material fine moulder's sand sifted through a fine sieve. Mix with *water* in a cup, and apply a small quantity to the parts that bear the hardest. Turn rapidly, pressing gently every few turns; if the work is large and the lathe is used, run slow; press and pull back rapidly to prevent sticking and ringing; apply grinding sand and water until a bearing shows on another part, then use no more new sand, but spread the old that has worked out over the whole surface. Turn rapidly, pressing gently while turning; withdraw the plug and wipe part of the dirt off and rub on the place a little brown soap; moisten with water and press the surfaces together with all the force at hand, turning at the same time. Remove the plug and wipe both parts clean; next try the condition of the bearing by pressing the dry surfaces together with great force. If the parts have been kept together closely while grinding, and the plug has not rubbed against the lower part of the barrel, the surfaces will be found bright all over, and a perfect bearing obtained. If an iron barrel and brass plug are used, or two kinds of brass, a hard and soft metal, soap should be used freely when finishing up, as the tendency to form rings is greater when two different metals are used.

In grinding a slide valve which has been in use until hollow places have worn in the surface, emery mixed with water, or sand and water, will be found better than oil, unless a light body oil, such as kerosene, is used. If water is used with the grinding material, soap should be rubbed on hollow places, and the grinding stuff should be applied to the high parts in small quantities, keeping the low parts clean and dry until an even surface is obtained all over, then the worn-out stuff should be used for finishing up. In polishing metal, oil that will "gum up" should not be used with the polishing material unless for a dead-fine polish. In polishing old brass work which has been scratched and tarnished by wear, pumice stone or bath brick should be used, with soap and water, for scouring off with, and rotten stone with kerosene oil for the wet finish, and dry for the final polish. The same method should be used for new brass work.

New work should require, when leaving the lathe and vise tools, but little polishing or grinding, and every good workman should try to avoid using an emery stick or emery cloth, as with proper care in the use of tools a great deal of grinding and polishing can be dispensed with.

FIG. VIII.

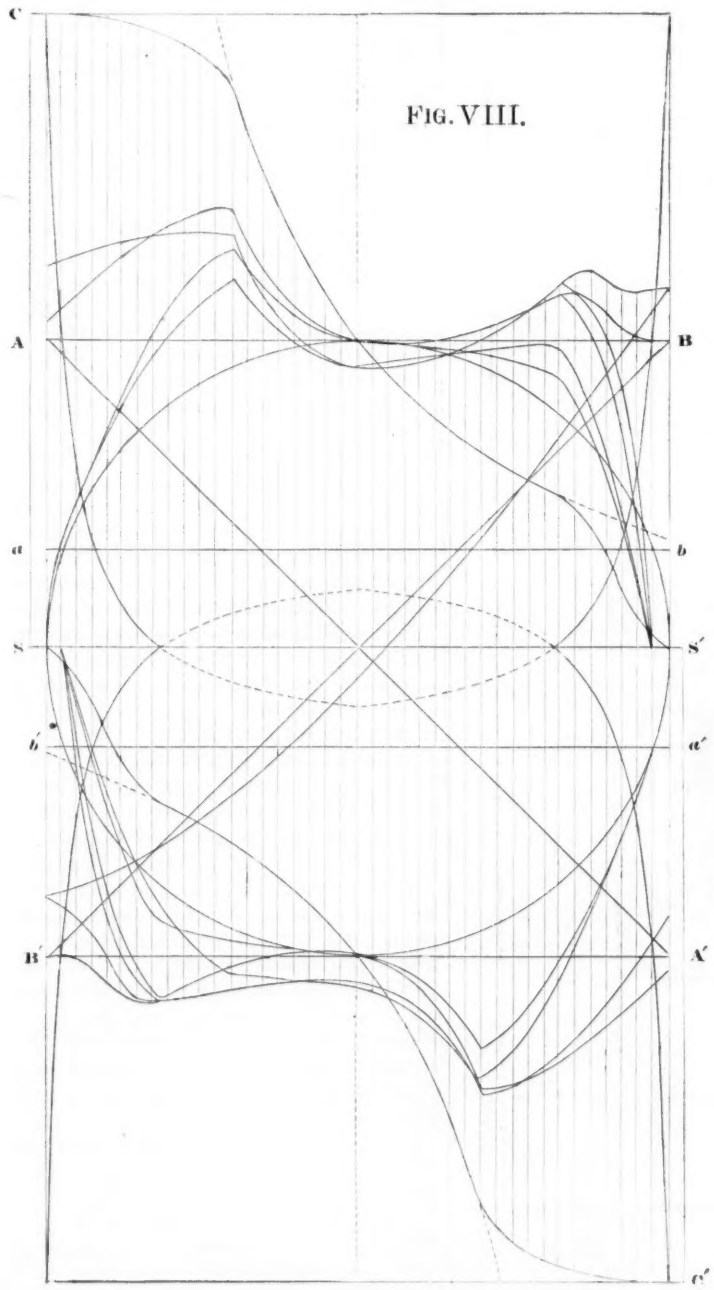


FIG. IX.

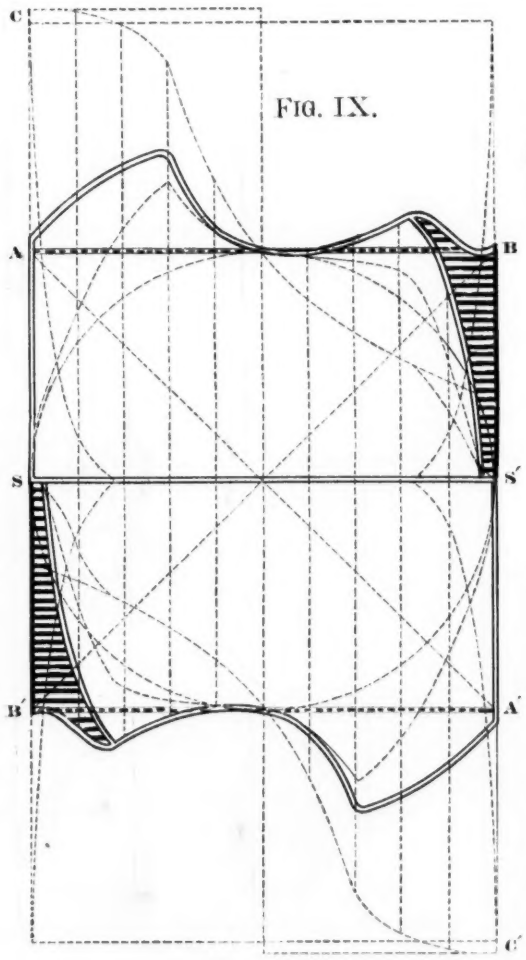


FIG. XI.

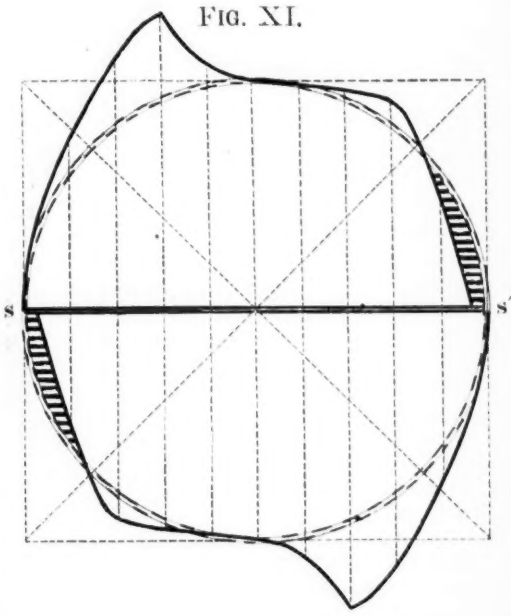
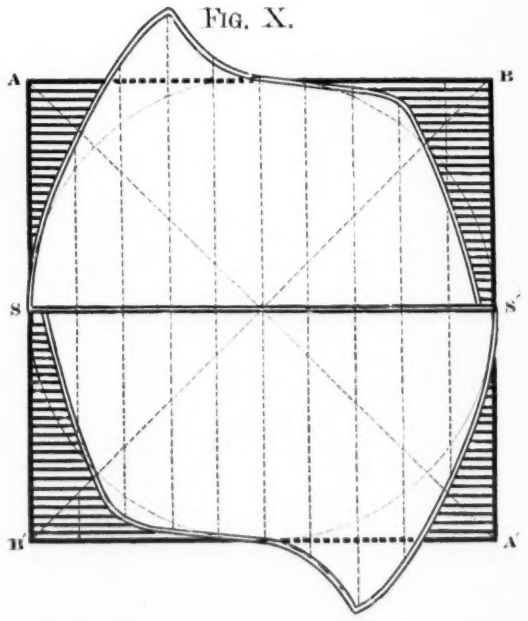


FIG. X.



Newly-Incorporated New York Companies.

American Heveenoid Rubber Company, New York; Edward Schell, Theodore E. Studley, and others, incorporators. Capital, $1,000,000, in shares of $100 each. For the manufacture of "Heveenoid" and rubber, and "Heveenoid" articles and analagous products. Nov. 13th.

Heim Leather Belting Company, New York; Otto Heim, James Callery, and others, incorporators. Capital, $75,000, in shares of $100 each. For the manufacture of leather belting, lace and picker leather, and in general such leather goods as are used for machinery purpose, as well as the tanning of leather for such purpose. November 15th.

The Germicide Company, of New York. Leopold Cohn, Edward J. Wallett, Jr., and others, incorporators. Capital, $300,000, in shares of $100. For the manufacture and sale of disinfecting machines and apparatus, and disinfecting and deodorizing chemicals, to be used in connection therewith. November 17th.

Baslet Petroline Soap Company, New York; Louis Baslet, John F. Vinal, and others, incorporators. Capital, $100,000, in shares of $100 each. For the manufacture and sale of soap and saponaceous compounds, and the disposal of rights to others to manufacture, under patents issued to Louis Baslet and others. November 17th.

Measurements of the Friction of Lubricating Oils.

BY C. J. H. WOODBURY, BOSTON, MASS.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

(Continued from last issue.)

These results seem to be intimately relevant to the most desirable limit of tension to the spindle band methods of operating cotton-spinning machinery. By weighing the band tension in various mills it was found that the practice of tying bands lacked uniformity. As an example of this variation: in one mill the bands of a single coarse frame are reported to vary from one to 16 pounds. In another mill, on finer work, a number of spindles had a range of from ½ to 2½ lbs. and in a third mill the band tension was between the limits of ¼ to 5 lbs. The effect of atmospheric changes upon the fiber of textile bands renders it impossible, with the present method of constructing frames, to keep them at a uniform tension, but this variation can be reduced by a little care. Is it not worth while for each spinner to learn the proper band tension required for his special work, and then keep within those limits? The whole power required to run the frame would not vary in direct proportion to the varying resistance due to the friction of spindles at various pressures; because the resistance of the friction in other parts of the frame connected with the spindles, the actual spinning of cotton fibers, and the alternate contraction and expansion of the bands, are conditions which are more nearly constant and in no case do they vary in proportion with the friction of the spindle; yet the variation is large, as shown by the following experiment made with the frame:

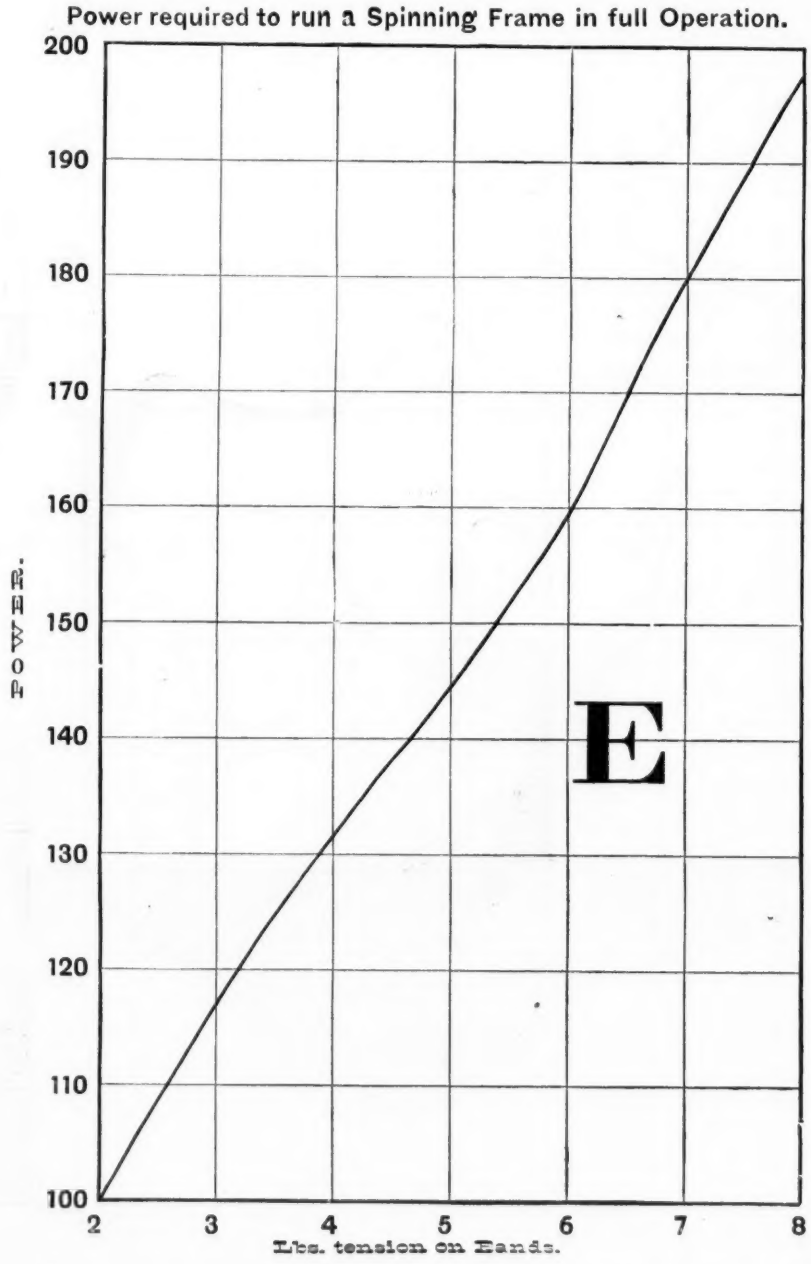
Mr. Geo. Draper, in a communication to the *Industrial Record* of June 1, 1879, gives the following valuable data on the subject: "A frame of Sawyer spindles was taken, spinning No. 30 yarn, ordinary twist, the front rolls running 95 revolutions per minute. The rings 1⅝" diameter, and the traverse of the yarn on the bobbin 5½". The dynamometer was applied, and the power required to drive the spindles with a side pull of the bands averaging 2 pounds to a spindle was ascertained. The bands were then cut off, and a new set put on with a side pull of 3 pounds per spindle, and the frame tested again, all things remaining as before. The operation was then repeated at 4, 5, 6, 7, 8 and 9 pounds side pull per spindle, with the result shown in the following table."

Calling the amount of power required to drive the spinning frame with:

2 pounds tension on the bands.....	100
3 " " " "	117
4 " " " "	131
5 " " " "	144
6 " " " "	159
7 " " " "	177
8 " " " "	197
9 " considerably more than double.	

The results are shown graphically in chart E.

The lubricant used is one of the most important factors in the cost of power. In the present condition of engineering science, it is impossible to state what exact proportion of the power used by a mill is lost in sliding friction, but in a print-cloth mill only about 25 per cent. of the power is utilized in the actual processes of carding, spinning, and weaving the fiber, not including the machinery engaged in the operation, leaving 75 per cent. of the power as absorbed by the rigidity of belts, the resistance of the air and friction. The coefficient of friction, under the conditions submitted by my oil tester vary at 100° 500 revolutions, from 7.56 per cent. in the case of 32° Ex. machinery oil manufactured by the Downer Oil Co., to 24.27 per cent. in the case of neatsfoot oil; and the result of this investigation confirms me in the opinion that the successful operation of a spinning frame is far more closely dependent upon the individual management in respect to the conditions of band tension, lubrication, and temperature of the spinning room, than all other causes combined. Not that some forms of spindle are not superior to others, but that, without wise supervision, the most desirable forms of spindle must fail to show the merits due to the skill of their promoters. It may be stated that within a close approximation the lubricating qualities of an oil are inversely proportional to its viscosity; that is, the friction decreases with the cohesion of the globules of the oil, for each other. The endurance of a lubricant is in some degree proportional to its adhesion to the surfaces forming the journal. An ideal lubricant in these respects would be a fluid whose molecules had a minimum cohesion for each other, and a maximum adhesion for metallic surfaces. The viscous oils will also adhere more strongly to metals, and hence, under the conditions of heavy bearings, it is obligatory to use such thick lubricants, knowing that the employment of an oil with great frictional resistance is infinitely preferable to the attempt to use an oil so limpid that it could not be retained between the bearings. With light pressures the more fluid oils are admissible, and in all cases the oils should be as limpid as the circumstances will permit. Oils with great endurance are apt to give great frictional resistance, and in the endeavor to save *gallons* of oil, many a manager has wasted *tons* of coal. The true solution of solving the problem of lubricating the machinery of an establishment is to ascertain the consumption of oil, and the expenditure of powder, both being measured by the same unit, viz., dollars.



The fluidity of the oils was measured by the following apparatus. A pipette was placed within a glass water-jacket where the temperature was controlled and kept constant by circulation from a reservoir kept at the desired temperature. The capacity of the bulb is 28 cubic centimeters and the orifice measures three and a half inches long and .039 of an inch in diameter.

The oil was drawn into the bulb of the pipette, and after the whole was brought to the desired temperature, the time required for its discharge accurately noted by a stop watch.

These observations were made on each of the oils for a series of temperatures varying from 50° to 150° Fah.

If the fluidity of an oil is the measure of its lubricating qualities, these observations would not be identical with the frictional results, because the pressure in this case was that due to a head of about five inches of oil, or about one-sixth of a pound to the square inch and rubbing against a glass surface; while with the frictional machine the pressure was five pounds to the square inch, and the surfaces bronze and steel.

In both cases, however, the character of the surfaces and the pressures were uniform conditions, and, therefore, they would not affect the relations of either set of experiments in their consistency with each other. If the lubrication and fluidity of oils followed the same law of variation with the temperature, the results of one would be directly proportional to those in the other, provided that all other conditions were preserved constant. Such comparisons showed that the relations of the fluidity to the lubricating qualities did not follow any uniform ratio.

At a low rate of temperatures, the fluidity increased faster than the lubricating quality of the oil; between about 70° and 110° the coincidence was quite close; at higher temperatures the fluidity does not increase so fast as the lubrication. There was not a very close correspondence between the fluidity of oils at the same coefficient of friction.

The result of these investigations upon the relation of fluidity to lubrication seems to indicate that fluidity is a concomitant rather than a cause of the anti-frictional qualities of a lubricant.

In the case of mining drills operated by condensed air, an intense cold is produced at the liberation of air, and on some such bearings, kerosene oil is the only lubricant which can be used. I think it extremely probable, that at these low temperatures, the viscosity of kerosene oil is equal to that of lubricating oils at the average temperature of bearings in general use. On the other hand, only the most viscous oils can be used in such extremely high temperatures as the cylinder and steam chest of steam engines.

According to the results which I have obtained, the coefficient of friction at 50° is about 75 per cent. in excess of that at 75°, and it seems to me that the manager of every mill, which is run by steam, ought to consider the question of the temperature of the mill in early morning during the winter months, whether, as a matter of economy, it is cheaper to warm a mill by increased friction on Monday morning, or to keep the mill and machinery warm during the interval from the preceding week.

The humidity of the atmosphere is an important factor in the mechanical operation of textile machinery, as well as in the fabrication of cotton. A year ago I submitted to the New England Cotton Manufacturers' Association measurements showing the effects of humidity on textile bands, and I am also of the opinion that there is a difference of friction in machinery due to atmospheric influences upon the lubricant.

Possibly the moisture condensed upon the cold metal from the atmosphere becomes commingled with the oil and thereby reduces its viscosity, diminishing the friction.

The question of endurance of oils has not been given in these experiments, because the consumption of oil varies with the temperature, and it is proposed to investigate the matter subsequently by running the machine and controlling the temperature of the discs to 100° by the circulation of water. The amount of oil consumed could be very easily measured by the difference in the level of the glass-feeding tube, or the weight of the oil required to preserve it at that level during the experiment.

In the detailed results the friction is given for the whole range of temperatures, but in the following summary 100° has been selected as the temperature which most nearly corresponds to the heat of spindle bearings.

To ascertain these temperatures, holes were drilled in the rails of a spinning frame, passing as near the bolsters and steps as possible; the bulbs of thermometers were inserted in these holes, and while the frame was in operation 2,586 readings were taken, covering a period of four weeks. The temperature of the air was noted from a thermometer placed in the middle of the frame.

The mean temperature of the bolsters was 8.10° Fah., and of the steps 6.74° Fah. above the temperature of the room.

Other experiments were made to learn the temperature of the bearings of the shafting. Holes about half an inch in diameter were bored in the upper cap of such journals, and a thin copper tube, closed at the lower end, inserted and extended nearly to the shaft. This tube contained water and the temperature was measured by a thermometer placed therein. There were journals in good running order whose temperature at the frictional surfaces was 140° Fah. This method of using thermometers was first suggested by Mr. Edward Atkinson, and I consider it the most accurate test of the anti-frictional qualities of a lubricant at the service of those in charge of machinery.

Great pains have been taken to procure pure samples of the oils experimented with, and they were obtained directly from the manufacturers; and to the courtesy of Mr. Thos. Bennet, jr., I am indebted for a large number of samples of sperm oils which were procured by him directly from the whaleships or refiners.

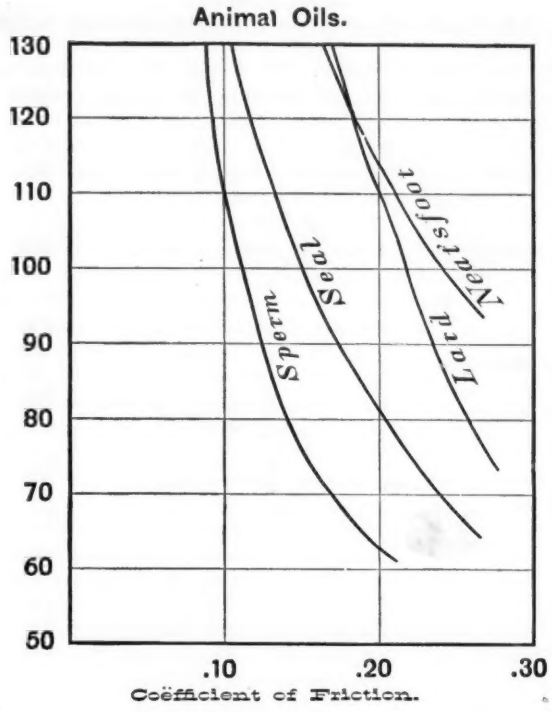
The following table gives the coefficient of friction at 100° Fah. and 500 revolutions, with a pressure of five pounds to the square inch:

No. of sample.	Kind of oil.	Coeff. of friction at 100°
1.	Mineral oil, (unknown)	.1635
28.	Downer Oil Co., Champion	.1732
10.	" " " Heavy Spindle	.1187
14.	" " " " "	.1233
19.	" " " " "	.1208
7.	" " " Light Spindle	.1113
20.	" " " " "	.1132
8.	" " "32' Ex. Machinery	.0756
2.	Leonard & Ellis, Valvoline Spindle	.1476
11.	" " White Valv. "	.1493
12.	" " Valv. White Loom	.1201
15.	" " " Machinery	.2243
13.	Olney Bros., German Spindle	.1190
16.	" " A "	.1103
3.	John P. Squire, Lard	.2181
4.	Bleached Winter Sperm A	.1067
5.	" " " B	.1217
6.	" " " C	.1170
9.	Aiken & Swift, Bleached Winter Sperm	.0956
17.	Aiken & Swift, Unbleached Winter Sperm	.1147
18.	Aiken & Swift, Bleached Winter Sperm	.1141
21.	Seal Oil	.1608
22.	Alex. Boyd & Sons, Neatsfoot	.2427
23.	Mixed animal and Mineral oil (Unknown) 1	.1608
24.	" " " 2	.1377
25.	" " " 3	.1190

Chemical examinations of these oils by Mrs. Ellen H. Richards, of the Women's Laboratory, Institute of Technology.

	Flash of vapor Fah.	Loss of evaporation in 12 hours at 140°. Per cent.	Nitro Sulphuric Acid test.
1.			
10.	338°	1.3	Dark yellow with much cake.
14.			
19.			
7.	314	2.7	Dark yellow, some cake.
20.			
8.	284	5.5	Slightly yellow, only a few flakes of cake.
2.	316	3.7	Dark yellow very thin layer cake.
11.	324	3.8	Slightly yellow not on brown specks.
12.	318	3.3	Yellow, not a single flake, no solid matter.
15.	286	7.2	Turned dark, gives a black layer of gum.
13.	322	1.9	Quite an amount of cake.
16.	282	5.0	" "
3.		+0.4	Hardened with much acid to a white solid mass.
4.			
5.			
6.			
9		+0.3	Thickened up a little like jelly.
17.			
18.			

With castor oil the friction was so great as to throw off the belt driving the machine; and as the time allotted for this work expired on that day, other arrangements for a wider belt could not be made, and it can only be said that its friction exceeds that of any other oil given in these tables.



The following diagrams give a graphical representation of the coefficient of friction for the several oils at temperatures between 50° and 130° Fah.

The anti-frictional properties of these oils under the condition of these experiments are expressed in the following order:

Manufacturers.	Oils.
Downer Oil Co.	32 Ex. Machinery.
Aiken & Swift.	Bleached Winter Sperm.
Olney Bros.	A Spindle.
Downer Oil Co.	Light Spindle.
Aiken & Swift.	Bleached Sperm.
Aiken & Swift.	Unbleached Sperm.
Olney Bros.	German Spindle.
Leonard & Ellis.	Valv. White Loom.
Downer Oil Co.	Heavy Spindle.
Leonard & Ellis.	Valvoline Spindle.
Unknown.	Seal.
Downer Oil Co.	Champion.
John P. Squire.	Lard.
Leonard & Ellis.	Valv. Machinery.
Alexander Boyd & Sons.	Neatsfoot.

It is no disparagement to the qualities of an oil that it is low in the foregoing list, except so far as it relates to the resistance of friction under these conditions. For circumstances of great pressure and slow motion, I am of the opinion that the order of the list would be varied; and if the question of endurance were only to be considered, still another change in the order would be necessary.

A portion of a lot of unbleached sperm oil (sample 17) was bleached expressly for these tests (sample 18), but the results of the two are so nearly uniform as to be practically identical. The result of bleaching does not affect the anti-frictional properties of the oil, although it undoubtedly reduces its gumming qualities.

The friction of sperm oil is subject to sudden variations which occur at certain temperatures for the same sample of oil. The explanation of this lies in the fact that sperm oil consists of a large number of varieties of spermaceti, each of which is liquefied at certain temperatures, at which the oil is relieved of waxy or at least gelatinous particles, and becomes a more perfect lubricant.

This is very apparent in the irregularities existing in the graphical representations of the test of samples marked B and C.

The friction of lard oil for high temperatures exceeds that of any other lubricant in the list; and this adhesive quality enables it to remain on tools used for cutting iron.

In conclusion, it may be stated that the data necessary to determine the safety and efficiency of a lubricant comprise:

1. The flashing point of its vapor, which is ascertained by slowly heating a sample over an oil bath, quickly passing a small flame over the oil and noting the temperature at which the vapor first flashes. The danger from an oil does not arise from the point at which the oil actually ignites, but at the lower temperature when the inflammable vapor bursts into flames, which communicate fire to a distance limited only by the extent of the vapor.

2. The quantity of such volatile matter is important both as respects safety and value. The heat of friction liberates that portion of the oil which is volatile at the temperature of the bearings; filling the mill with a dangerous, noxious vapor, and also dissipates in the air a portion of the oil which is paid for by the gallon, but does not serve to give any return of value in lubrication.

The quantity of matter volatile under 140° Fah. is measured by heating a known weight of oil in a watch glass, and maintaining a constant temperature of 140° Fah. for twelve hours. This simulates the conditions of the temperature of the bearings mentioned previously, and the maximum time that it would be consecutively heated.

In the case of mineral oils the loss from evaporation varied from less than one up to thirty per cent. With animal and vegetable oils there is a slight gain in weight due to oxidation.

3. The tendency to spontaneous combustion is estimated by a uniform amount of cotton waste smeared with a certain quantity of oil.

A thermometer whose bulb extends to the center of the mass indicates any rise of temperature due to oxidation. Any gain of weight during the preceding evaporation test shows a liability to spontaneous ignition.

4. Freedom from acid is an important factor in oil, because acid is a cause of corrosion of metals, and will tend to remove the oil from the frictional surfaces where adhesion is indispensable. The presence of acids is shown by corrosion of copper.

5. The anti-frictional properties of an oil can be measured only by direct trial under the desired conditions of pressure, velocity, and temperature.

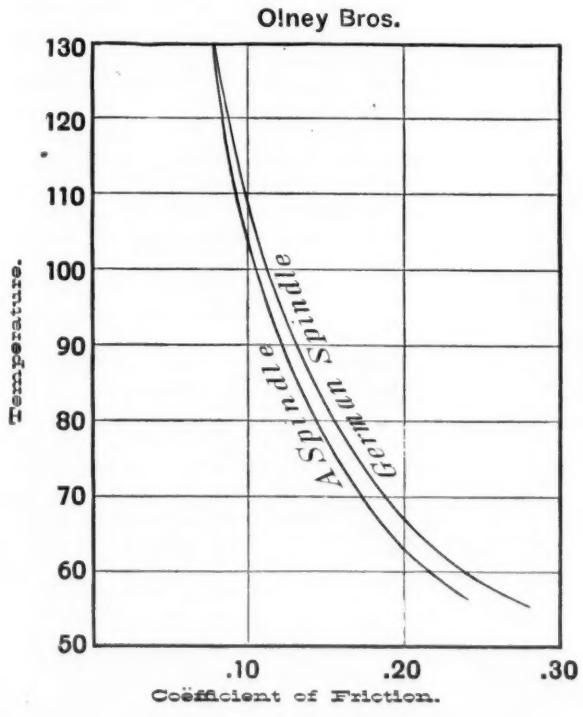
The results of these experiments show that a lubricant must have a certain adhesion to the frictional surfaces to maintain free lubrication; but beyond that point the adhesiveness of the oil resists the motion of the surfaces, increasing the friction. A thick oil gives greater frictional resistance than a thin one; and, where ease in running is the object, the most limpid oil should be used, consistent with the conditions of the specific circumstances of the bearing.

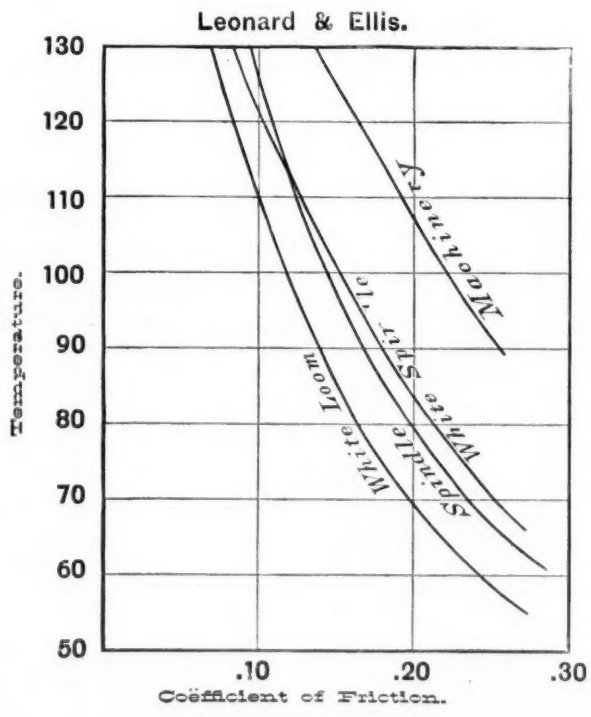
In general terms: the specific gravity of an oil gives no indication of its value as a lubricant, in qualities of viscosity, body, or endurance.

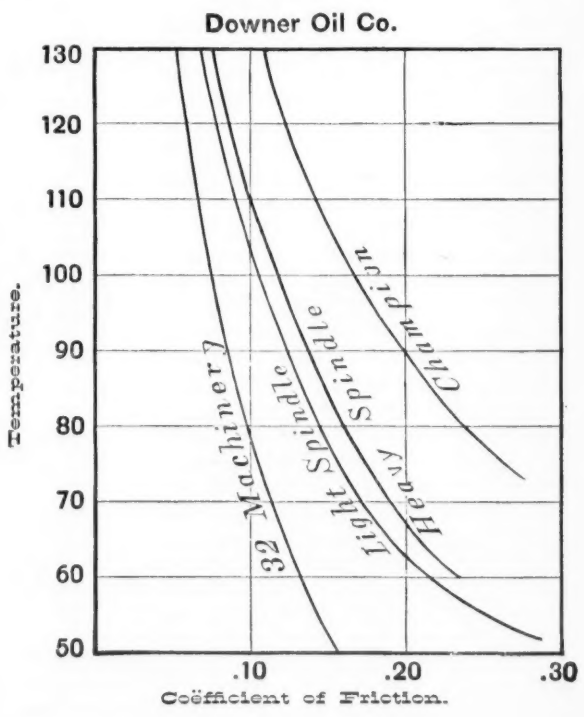
This work is the result of a part of the ordinary service of certain mutual insurance companies. As there appears no relation between underwriting and an investigation involving questions of chemistry and mechanics, I beg to add a few words by way of explanation of the system of the factory mutual insurance companies. The better class of factories are associated together in mutually sustaining each other's losses by fire, forming the most powerful scheme of co-operation in the world. The amount of property so indemnified is some two hundred and six millions dollars, or an amount exceeding three-fifths of the aggregate national bank circulation of the United States.

The surplus of the year's work is distributed among the assured, giving the clients protection at the cost of the annual losses by fire and the expense of administering the company; the latter item amounting to a sum but little in excess of the interest accruing from the premiums deposited for indemnifying the claimants for losses.

Their policy has been to anticipate all preventable causes of fire, prescribing the ounce of prevention. Instead of charging a







premium commensurate with the estimated hazard of a structure, and thus betting against a chance; they demand that the mills shall be brought up to the standard of their associates in all matters of approved construction, equipment of fire apparatus and orderly supervision. Instead of making the rate conform to the risk, the risk is brought up to the rate. Mohammed does not go to the mountain, but the mountain comes to Mohammed. To achieve this end, all that theoretical knowledge can suggest, or practical experience accomplish, is utilized.

The result of this system has served to reduce the cost of indemnifying cotton mills against loss by fire, by a sum equal to saving their capital every thirty-five years, if the saving be compounded at 6 per cent., reducing in cost every piece of New England cotton fabric.

In demanding a better class of mills as the art of their construction has been developed, in all that pertains to light, warmth, sanitation, ample stairways, protected elevators, and the abolition of garrets; in everything relating to physical comfort and safety they have incidentally accomplished more for the amelioration of the employed than all the class legislation ever enacted in the Commonwealth of Massachusetts.

Furthermore, the capital employed in textile manufacturing has reaped an indirect benefit from mutual insurance. Besides the reduction in rates, the decreasing number of destructive fires in such mills has also diminished the losses arising from interrupted business—a risk which is not covered by mutual insurance.

A Primitive Steam Buggy.

BY F. G. WOODWARD.

The illustration of a modern steam buggy, in the AMERICAN MACHINIST of Oct. 30, leads me to present a delineation of a somewhat similar machine of a much earlier date. This one was designed and constructed by a steam-engine builder in Brattleboro, Vt., some forty-five years ago, and was capable of working pretty lively on a good road. The casing of the boiler, the seats, and other portions of the superstructure, are omitted in the sketch, in order to show more clearly the arrangement of the boiler and machinery. The boiler of this machine is its chief novelty. It consists of a series of tubes *A*, bent loopwise, or in the form of the letter V, their ends terminating in two cylinders *C*; the cylinders being united by two pipes *G*, the fuel door being between them. The lower branch of the tubes form the grate, and the upper branch the crown of the furnace. The whole is inclosed in a sheet iron case; the upper cylinder is surmounted by a larger cylinder *D*, which serves as a steam chamber. It will be noticed that the drivers *h*, are worked by endless chains *E*, the center of the drivers *h*, and that of crank shaft *B*, and of the cylinders *F*, being exactly in the same horizontal plane, of course. It will be observed also, that the large chain wheels upon the drivers are just of a size in the sketch, but I think that these wheels were of unequal size on the machine, so as to give two speeds to the vehicle, only one of the drivers being in gear at a time. This endless chain principle is employed on the Manchester self-propelling fire engines, and gives good results with a singe driver.

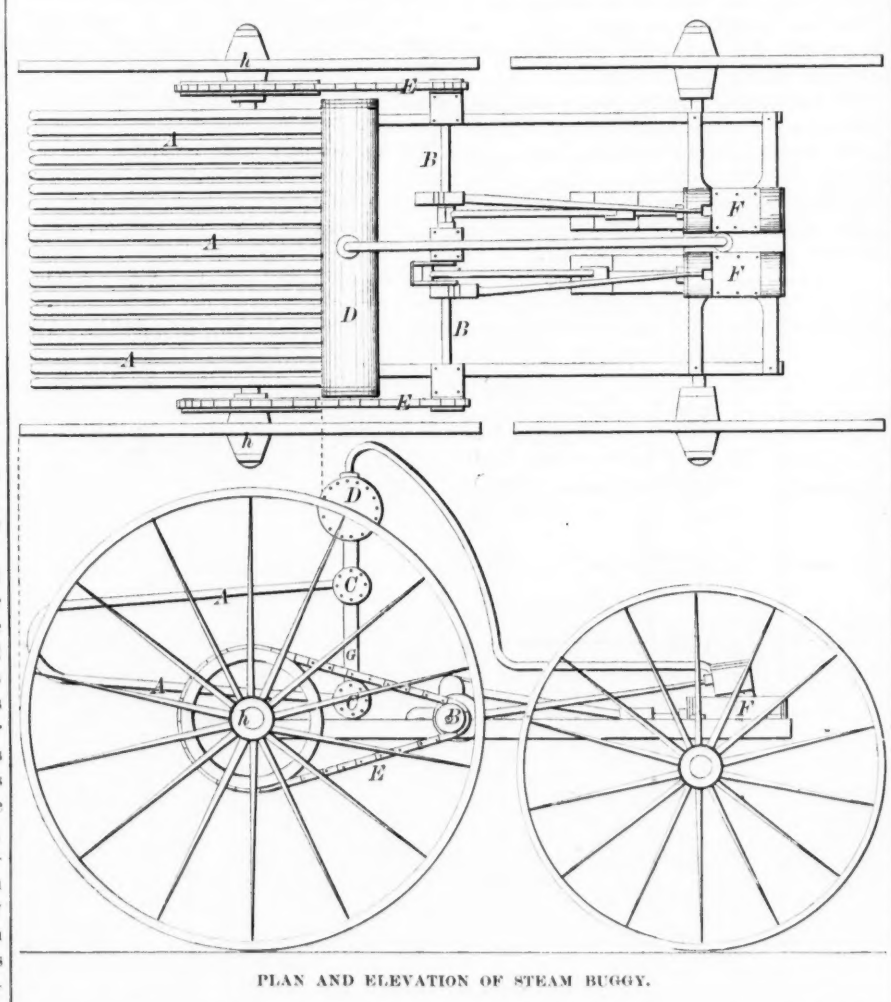
A recent French invention of considerable interest is an inproved motive-power engine, worked by means of atmospheric pressure under the effect of barometric vacuum. By means of two connecting rods, a shaft receives a rotary motion, produced by the action of two cylinders placed in two parallel cylinders. Each cylinder is closed at one end, and communicates with an oscillating cylinder in the form of a U, which may be placed either horizontally or vertically. When it is placed horizontally and filled with mercury, as well as the motive cylinder, the piston is at the end of the cylinder; the oscillating cylinder is then placed in the vertical position, the mercury falls, and the barometic vacuum being produced, the piston pushed by the atmospheric pressure reenters the fixed cylinder. The oscillating cylinder then again takes a horizontal position, and, the mercury re-entering the fixed cylinder, the piston moves in the contrary direction. The second fixed cylinder is so placed that its piston and that of the second oscillating cylinder are the reverse of the cylinder. Counter weights equilibrate the weight of the U-shaped cylinder full of mercury.

Letters From Practical Men.

PROJECTION OF DRAWINGS AGAIN.

Editor American Machinist:

I was glad to hear from Mr. Falkenau (on page 6, No. 42), answering my letter in No. 28. Before going further, I will ask his pardon for being in a slightly pugnacious mood (it must have been just before dinner) when I attacked his system. A more courteous view would, of course, see some common sense on both sides of such a question. I will also say, that I was mistaken in supposing that most of the best engineering practice favored the use of the "1st angle."



PLAN AND ELEVATION OF STEAM BUGGY.

On the contrary, opinion seems to be pretty evenly divided between the two systems, and I quite agree with Mr. Falkenau in thinking it of considerable importance that there should be a uniform rule adopted, one way or the other. This would be a good question to be thoroughly discussed by the A. S. M. E.

After reading Mr. Falkenau's letter, I wrote to several engineering concerns (in addition to the two he mentions), whose names occurred to me at random, and none of whose practice I knew. They were: W. B. Bement & Son, W. Barnet Le Van, Harlan & Hollingsworth Co., David W. Pond, The Pratt & Whitney Co., Niles Tool Works, and the Brown & Sharpe Manufacturing Co. Their courteous, and in some cases lengthy, replies elicited the following facts: The first four named use the "first angle" system, H. & H. Company and D. W. P. occasionally varying from it where more convenient for the paper. The Pratt & Whitney Co. use both 1st and 3rd angles without preference. The Niles Tool Works usually use the 3rd angle, but frequently the 1st also, especially on small work. The Brown & Sharpe Manufacturing Co. always use the 3rd angle, as do Wm. Sellers & Co. and the I. P. Morris Co. Some of the gentlemen named regard the matter as of little importance, while others think a uniformity of practice very desirable. Of course this correspondence does not ascertain the average opinion on the question, which result can be obtained only by sending circulars of inquiry to all the machine shops in the country; or, say, to all above a given size.

Now that I have expressed a proper respect for the 3rd angle method, I am ready to answer Mr. Falkenau's last arguments, not yet being at all converted to the other side, though willing to conform my practice to any method that may at some future time be adopted as a general standard. Regarding your correspondent's "natural method" of walking around the several thousand pound cylinder casting, I admit that he is all right as concerns the elevations (if it don't happen to be up in a corner or down in a pit), but methinks he must possess the pinions of the gentle mosquito when he comes to hovering over it for the plan. And what about an inverted plan? He must, then, have the burrowing ardor of a prairie dog, and a very earth-penetrative electric light, so he can see the cylinder while at a safe distance below it. As to the unnaturalness of revolving the mental image of the cylinder over the paper (because it is bulky), we must remember that it has probably been reduced in scale, and is of such a manageable size that two or three views of it will go on a sheet of ordinary drawing paper. Its weight having been reduced as the cube of this scale reduction, we shall hardly need Goliah of Gath in our draughting rooms yet awhile.

In regard to seeing the object through the paper easier than the paper through the object, I would say that draughtsmen here in New Jersey never try to show any paper through the object, but only around it. In the space bounded by its outlines, they try to show a conventional representation of its surface or section as the case may be. Of this it seems more natural to obtain a clear view by not imagining the opaque paper between it and the eye.

In his next paragraph, Mr. Falkenau quotes my words, "there can be no positive rule, etc.," and totally misapprehends their meaning. They referred only to a convenient starting point upon the paper, and did not mean that there should be no rule about which system of projecting to use. The idea was merely that any principal view might be first shown, and then such auxiliary views derived from it as the case happened to require: *e. g.*, suppose a complete front elevation was wanted first; then a right or a left side elevation, or a plan, or an inverted plan, would require the first view to be revolved to the left, or right, or forward, or backward, respectively. Of course the position of the primary view on the paper depends upon which other views are desired. If all of them, the middle of the sheet is the starting point. Had Mr. Falkenau understood this as I meant it, he would not, I think, have charged me with "ignoring theory."

Although for convenience we have called these two opposite methods the "1st angle" and "3rd angle" systems, we must not lose sight of the fact that neither of them conform strictly to the conventional two planes of descriptive geometry. We use these for one elevation and its derived plane: but if we wish another elevation, we must erect an auxiliary plane of projection perpendicular to the other two. These three intersecting planes, mentally "flopping" up and down with the positions of their respective axes to be kept in mind, are too cumbersome for the imagination of the average workman. Probably not one such in five hundred has studied descriptive geometry at all. Neither has, perhaps, more than one in fifty of his employers, nor a very large proportion of draughtsmen either.

My own experience is that, although I learned from my "Davies' Legendre," years ago at school, to always work in the "first angle," I do not, when drawing, think in the language of the revolved (and involved) planes of the above-mentioned science; and probably few others do.

Practically, my method consists of regarding the paper as (what it actually is) one fixed horizontal plane of projection, over which is laid the object (reduced to its proper scale) in any position desired for the primary view. It (the object) is then revolved outward 90° in any direction required to show the secondary views necessary. Sometimes it is again revolved from any of the last-mentioned positions, then showing a tertiary view.

As I understand Mr. F.'s method, it also regards the paper as one plane, but imagines it transparent, and to be carried around in front of the various sides of the object, successively. This certainly seems to me more complicated than the other system, especially the delving underneath the object necessary for a bottom view—in general, the mental carrying about and revolving of the person and the paper when they are both really stationary. The actual object is absent in both cases; as it has to be imagined anyhow, is it not easier to call it up in various positions, and allow the two real things (paper and person) to remain still, than it is to keep all three as airy creatures poised in space? Yours very truly,

OBERLIN SMITH.

BRIDGETON, N. J., NOV. 15, 1880.

HEATERS ON NON-CONDENSING ENGINES.

Editor American Machinist:

Why is it that heaters are not in more general use on condensing engines? We certainly can get feed water at a temperature of 100° from the hot well without a heater, but, although we cannot hope to heat the feed water to as high a temperature as is obtained from the use of some heaters attached to non-condensing engines, still I think the general efficiency of a condensing engine is increased by the use of even the ordinary feed water heater.

I think I can safely say that the pointer of the vacuum gauge on our lake steamers rarely gets below 24. There are a few exceptions. The reason generally given for this poor vacuum is, that to show 27 or 29 on the gauge, an increased amount of injection water is required, which lowers the temperature of the hot well, and consequently the feed water, so that we are prevented from getting the economical benefit of a better vacuum, on account of having to use colder feed water. Now, by forcing the feed water through a heater, on its way to the boiler, we can get our 27 or 29, if possible, and still keep up, if not increase, the temperature of said feed.

Practically, a terminal pressure of five pounds above zero is a desideratum not often gained, as even in our best condensing engines, seven or ten pounds is considered good. In that case, our exhaust will be at a temperature of from 175° to 190°, so that there ought to be no difficulty, by the use of even a moderately long heater, in heating the feed water to 120°; and as the terminal pressure rises, so will the benefit be more marked. Before giving the result of some trials with our heater, I must explain that on account of the engine being rather small for the work to be done, we cut off at one-third of the stroke, which gives us a terminal pressure of about 23 lbs. above zero, 55 lbs. being the boiler pressure. The heater is built of boiler plate, such an one as would be considered the worthy emanation of a country blacksmith shop, containing 110 one-inch lap-welded iron tubes, 3 feet long, for the passage of the exhaust steam; this is far too short for best results, but we were cramped for room, and could not get the heater any longer.

During the following different tests the steam was kept at a uniform boiler pressure of 55 lbs.; revolutions, 66 per minute; cut off, one third of the stroke; terminal pressure, 23 lbs.; indicated H.P., 291. When feeding from the hot well, at a temperature of 102°, and partially closing the suction cock, so that the pump got just water enough to feed the boiler, all the water passing through the heater going into the boiler, the temperature of the feed entering the boiler was 152°; the temperature of the injection water was 40°; vacuum, 24. When feeding from the lake at a temperature of 40°, all the water passing through the heater entering the boiler as before, the temperature of the feed was 146°; vacuum, 25. When feeding from the lake, and the pump pumping its full capacity into the heater, what was not wanted for the boiler being allowed to pass overboard, after passing the heater, the temperature of the feed entering the boiler was 138°; vacuum, 25½.

Regarding the vacuum, I might explain that our condenser is one of those very unhappy mixtures of boiler plate and cast iron that require a separate ventilator to supply the air for the leaks, so as not to rob the furnace of their share, and of which the best word that can be said is that they are about dying of old age. But before we added the heater, 22 was considered a booming vacuum. You will see by this, that to an engine with limited condenser capacity, the addition of a heater is beneficial in other ways than keeping up the temperature of the feed.

Another advantage gained by the addition of a heater to a condensing engine is in case of the breaking down of the air pump valves connected therewith, or anything by reason of which the engine is worked as a non-condenser. The feed water, by passing through the heater, is moderately heated on entering the boiler.

I have a memorandum of such an accident where, on account of getting aground on a sand bar and condensing the exhaust steam with a sand blast instead of water; after getting about twenty miles out jumping into a big sea, away went our air pump valve, cut to pieces by the sand when on the bar. We were afraid of getting in the trough of the sea if we turned, and we had a hundred miles ahead of us, but we let her go. We allowed the exhaust steam to get outside through the condenser the best way it could, as we couldn't stop to remove the pump plunger or valves; altered the feed pump so that it fed from the lake instead of the hot well, and although the temperature of the lake was 40°, that of the feed water after passing through the heater was 142°.

I cannot imagine why the heater tubes should leak in this case any more than when in use on a non-condensing engine. I have been shipmate with the heater here spoken of for five years, and so far there is no sign of a leak. I think if something besides tallow were used in the cylinder, or if used at all that it be treated as it is advisable that the average whisky should be, that is, diluted—that leaky heater tubes would be a rarity. About one-quarter of a pint of black oil to three-quarters of a pint of tallow will form a mixture which will prevent many of the evils resulting from a continued use of neat's tallow.

I do not consider brass tubes any better than good iron ones, or at all necessary. In fact, owing to the unequal expansion between the boiler-plate shell of the heater and the brass tubes, their use might be objectionable. Yours truly, T. W. HUGO,

Steamer City of Owen Sound.

Owen Sound, Ont.

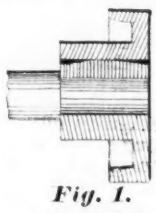


Fig. 1.

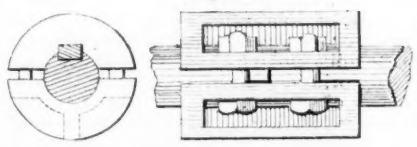


Fig. 2.

"EASY WAY" ON COUPLINGS.

Editor American Machinist:

I am the only man in America who knows how to make a lathe leg for a 16″ swing-engine lathe, or a coupling for a shaft suitable for any size from ¼″ to 20″ diameter. I'll tell you about the coupling in a minute. I want to find a little fault with Chordal's coupling first, because it's a heap easier to find fault with the best man's work than it is to beat it. All the same, I would just like to hear what fault Chordal, or any other man, can find with the coupling I use, which has every virtue and no vice, and still exists on earth.

Chordal never could drive an iron key for me, in a coupling nor anything else, if I knew it, and I don't see why he should turn a tit on one shaft and have a socket for it in the meeting end of the next length, so long as the two are of the same diameter, because he has only to slip one shaft through into the other coupling, say an inch or so, to have the same job in a good deal better shape, and in the "easy way," which is my war cry in the shop.

Fig. 1, shows a key as I think it should be fitted for flange couplings, if people will be fools enough to order and wait for them. The key should be fitted to bear for, say, ¼ of its length, on the coupling in the middle. This will bring the coupling to the same place every time. The key should, of course, be made of steel, and have hard ends, drawn to spring temper. I don't see why Chordal wants coupling bolts $\frac{1}{16}$″ slack; they should not be driven, but they should fill; why not?

In Fig. 2 I give an end and side view of the coupling I use. I invented it, and thought it was a new thing, because I supposed that, since it was cheaper and proved better than any other coupling, it would have been in universal use had it been known previously. I was younger then, and had not learned that everybody takes the hard way first, and that a man has to be smarter than common to change a bad, expensive thing for a cheap and good substitute. Probably one reason for the persistence of the flange coupling is to be found in the pride of the workmen, who, perfectly conscious that they have never yet made a flange coupling that could be put on twice alike, want to try the blessed thing just once more. No matter what the mental philosophy of the thing is, I am quite sure I did not originate the clamp coupling, as I have seen examples which were made before I ever saw a machine shop; and from a shop which has its foundry shaft, put up twenty-five or thirty years ago, coupled with these same clamp couplings, I saw as bad a job of flange couplings come last week as ever was made in the world;—bored and reamed, turned and drawfiled, scraped and polished, with keys driven right sock up, and just showing on the outside ends, so that Tubal Cain himself couldn't get them out in a week. The foreman said they were "true as a hair," and the Dutchman who keyed the flanges on, said, "Dem gouplinks doand gum auf pewdy gwick," and the foreman and the Teuton both told the truth. I told the foreman they were a good solid job, and I told the truth, but I didn't tell the whole truth. I could see those couplings in the cold mill where they were going, lying on the floor; I could see a man chipping the shaft away so he could get at the ends of the keys with a drift. I could see drift after drift bunged up, and hear the chorus of deeply grateful anathemas from all hands when the key finally did jump out and break the shin of the proprietor, who was looking on, and right in the way, while the sledge followed the drift and pounded it into the key way so that it took another quarter of an hour to get that out. I could see the sledge glance up when the drift stopped and knocked a chunk out of the bolt head flange; and then I could see the whole resources of the establishment brought to bear on that coupling to induce it to part company with the shaft. It is hard to tell how it is finally done; probably at last by warming up the flange in the fire and pounding the hub with a naked sledge, patience and that infinite tenderness for finish which preserves many a polished job, that by rights ought to go straight from the emery stick to the scrap heap, having been long since exhausted. Then I could see all hands gather around the blackened, battered nuisance as it lies on the floor, while the proprietor rubs his damaged shin, and the boy who held the drift in the tongs when the last blow was struck feels the blood blisters on the hand he keeps in his pocket, and the man who is putting up the shaft does a little mental arithmetic over the problem of how long it will take to put up ten lengths of shaft, if it takes three-quarters of a day to get one coupling off.

With the coupling shown in the sketch there is no good work needed, and no hard work possible. No key is needed for shafting up to 2″. The key, of course, bears enough on top to keep it in place. The couplings come off in about a minute, under the pursuasion of one man and a monkey wrench, and go on just as easily as they come off, and the whole job is true, sure and certain.

I use a ¾″ bolt for $1\frac{5}{16}$″ shafting, and other sizes in proportion. The only points to be observed in designing are to put in iron enough, and give plenty of room to turn the nuts with a monkey wrench. Never make a job for special wrench unless the wrench stays on all the time. I make the $1\frac{5}{16}$″ coupling one inch thick all over in the pattern; plane the two flat faces that come together, clamp the two halves together and drill and ream the holes, put in the bolts and $\frac{1}{16}$″ liner between the halves, and then bore and ream the seat for the shaft, put the job on an arbor and turn and face it. It is then ready to use, and to give satisfaction, complete and entire. EASY WAY.

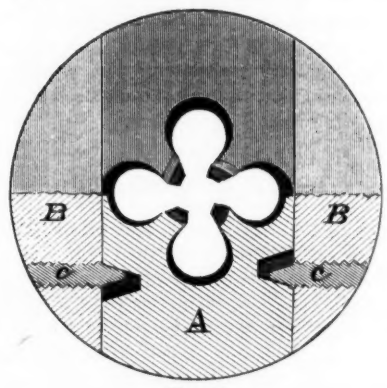


FIG. 3.

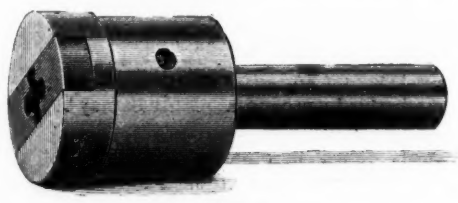


FIG. 1.

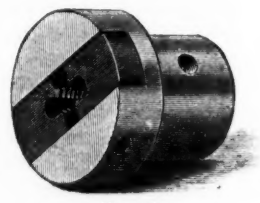


FIG. 3.

ADJUSTABLE DIE FOR SCREW MACHINES.

Adjustable Die for Screw Machines.

One of the greatest labor-saving machines in use at the present day, and one which is being appreciated more the longer it is used, is the screw machine. Studs, set screws, and many similar things which were formerly made in a lathe, are now made equally well and much more quickly in the screw machine by manufacturers, who understand the value of improved machinery. The chief, and perhaps the only, objection to their use on all except small articles, where screw threads are cut, has been the cost and difficulty in getting dies which would make good threads and keep the same size, or which would make all the screws correspond with size of tap. This difficulty is claimed to have been overcome by the patentees and makers of the die shown in Figs. 1, 2, and 3. Fig. 1 shows the die, collet, and collet holder ready for use in the turret head of a screw machine. Fig. 2 shows the collet and die, which are kept together ready for use. The collets all fit the holder, and all parts are interchangeable, so that when dies are worn out, new ones can be sent from the factory where they are kept in stock. Fig. 3 shows a sectional view of the die, with method of adjusting it to allow for wear or to correspond with the tap. It being understood that the same screws which adjust the die also hold it down, and that the adjustment is only intended to allow for wear, or to make articles threaded fit tightly or loosely as required, no further explanation is necessary.

This method of cutting screw threads is only new as applied to screw machines. The dies have been used in the Little Giant screw plates and bolt cutting machines made by the same parties, for nearly four years, and have given excellent satisfaction on screw machines.

All sizes of dies, from $\frac{3}{16}$th inch to $1\frac{1}{2}$ inches, have been thoroughly tested, and have stood the test remarkably well.

A specialty is made of these dies by the manufacturers, Wells Bros., Greenfield, Mass.

The amount of capital now seeking investment in this country, and especially in New York, is greater than ever before, yet it avoids mining because of the sad experience of the past year or two, especially in Leadville properties. Good mines, properly indorsed by competent and trustworthy experts, are securing or have secured capital, and a number of such properties are now paying enormous returns on the capital invested in them.—*Engineering and Mining Journal.*

The construction and repair shops of the Pennsylvania Railroad, located at Altoona, Pa., give employment to about 3,000 men the year round, and disburse among them for wages nearly $4,000,000 annually. The machine and car shops cover some 40 acres in extent, and consist of an iron foundry, a brass foundry, a wheel foundry, a blacksmiths' shop, a lathe shop, an engine-erecting shop, and a car-building shop, besides a chemical laboratory and physical testing department.

On December 8th the second convention of Illinois cane growers and sugar planters will meet in Springfield. A strong effort is being made to prove that all the sugar that that State consumes — some $10,000,000 worth annually—can be raised on Illinois soil at a cost not exceeding the present, besides creating a valuable industry.

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CONTENTS.

PAGE.

High Ratios of Expansion and Distribution of Unequal Pressures in Single and Compound Engines. J. C. Hoadley, C. E. 1
Newly Incorporated New York Companies.. 3
Measurements of the Friction of Lubricating Oils. C. J. H. Woodbury..... 4
A Primitive Steam Buggy. F. G. Woodward..... 6
Letters from Practical Men..... 6
Adjustable Die for Screw Machines..... 7
Ventilation of Workshops..... 8
Tests of Lubricating Oils..... 8
Single and Compound Engines..... 8
How to Restore American Ocean Commerce..... 8
The Apprentice..... 8
Location of Cotton Mills..... 9
Manufactures..... 9
Machinists' and Engineers' Supplies. 10
Iron Review..... 10
Metal Review..... 10

Ventilation of Workshops.

At this season of the year, when machine shops are necessarily closed and heated, the question of proper ventilation should come prominently before superintendents and proprietors. That it does not add anything directly to the revenues of the business is no adequate excuse for neglecting it. The health and comfort of workmen are not taken into due account by most shop proprietors, therefore the trade of a machinist is looked upon by many people as unhealthy and undesirable to follow.

The first principles of correct ventilation are a sufficient ingress of fresh air near the floor, and a sufficent egress of the foul air near the ceiling. By far the greater number of shops have to depend for ventilation upon the chance admission of pure air through chinks in doors, windows and floors, and the escape of impure air through the same openings. In very cold weather, where such shop rooms are well heated and a number of workmen employed, headache and drowsiness are developed, which serve to make the men less keen and active, thereby serving as a hindrance to the work. Thus does disregard of comfort and good sanitary arrangements for employes re-act to reduce employers' profits. Ventilating flues should be in the walls of every shop; but if they are not provided, and cannot be supplied, ventilators should be placed in the windows, and some adequate provision made to admit air near the floor. In some large cities, laws are in force requiring workshops to be properly ventilated; but where no such laws exist, the moral obligation is just as binding upon shop owners.

Tests of Lubricating Oils.

It is not an extremely rare undertaking for a manufacturer, a railroad company, or any other large consumer of lubricating oils, to make what are intended to be elaborate tests of different lubricants, in order to make use of the information thereby obtained in securing economy. But such experiments, for private benefit, are almost always deficient in carefulness of preparation or thoroughness of prosecution, and, under these circumstances, it is next to impossible to make any two results agree. In the paper on "Measurements of the Friction of Lubricating Oils," which was presented by Mr. C. J. H. Woodbury, at the recent meeting of the American Society of Mechanical Engineers, and which we had the pleasure of laying before our readers in our last two issues, details and results of reliable and exhaustive experiments with oils are given in such a way as to make the paper of exceptionally high value to users of machinery lubricants. As the work was conducted in the interests of the Mill Mutual Insurance Companies, of New England—corporations that have vast risks upon mill property throughout that section of the Union—in order to give unquestionably correct information to the insured as to the kinds of oils that are safe and desirable to use, the value of the paper will, in some degree, be apparent before carefully studying it.

It is certainly one gratifying feature of the advancing spirit of the age that valuable mechanical information like this, which has been costly of attainment, is freely given to the public, instead of being hidden under the particular bushel belonging to the parties at interest in developing it. For its open dispensation, the mechanical community are indebted to Mr. Woodbury no less than to the insurance companies, under whose auspices the work was carried on.

As mentioned in the earlier part of the paper, after investigating nine different testing machines, and finding that none of them were reliable enough to furnish constant duplicate results, the apparatus therein described was specially constructed to give reliable data. This fact is worth the attention of manufacturers of testing machines, and we commend the paper to their attentive perusal.

The paper closes with a summary of the objects and successful operation of the mutual insurance companies, and explains the relation existing between underwriting and investigation, involving questions of chemistry and mechanics, as embodied in the system of the factory mutual insurance companies.

In the discussion which followed the reading of the paper, Mr. Woodbury made the following remarks:

Having obtained the cost of lubrication in one establishment, there is a difficulty in estimating its relative economy, because there is a lack of similar data from other establishments, and there is an infinite variety of causes which render comparison out of the question. I know of but one reliable source of comparison of the cost of lubrication, and that is the tables compiled by Mr. Edward Atkinson, President of the Boston Manufacturers' Mutual Insurance Company. In August 1878, he obtained from mills representing over 4,000,000 spindles in the manufacture of plain cotton goods, detailed statements giving the amount and kind of cloth produced, and the quantity and cost of lubricants used during periods of six or twelve months. I will refer only to the mills making cloth from No. 33 yarn, mostly print cloths; all consuming the same grades of cotton, and producing goods whose prices are governed by rates established in open market. The management of these establishments is usually corporate, the capital large, the profits small and competition keen. I do not know of any set of industries in this country where the cost of lubrication ought to be so nearly uniform. In fifty-six of these competing mills, the quantity of oil per 1,000 pounds of cloth varied from 1.03 to 2.88 gallons; and the cost of oil for the same production of cloth varying from 58 cents to $2.58—a variable cost of 379 per cent. for lubricating the machinery to perform the same work. These facts were collected before the examination of oils was begun. In August, 1880, Mr. Atkinson made a similar computation of the cost of lubrication in the mills insured in the company of which he is president; and, in comparison with the tables of two years ago, showed that the cost of lubrication, per 1,000 pounds of cloth, had decreased 33 per cent., or $180,000 per annum in the aggregate. The figures, in detail, were submitted to several extensive dealers in oil, and two-fifths this sum was estimated to be a liberal allowance for the reduction in cost due to fall in prices of oil. *The remaining* $100,000 *per annum seems to be an example of the commercial value of scientific work.* Prof. Ordway's chemical investigations in this matter have resulted in the general abandonment of dangerous volatile oils, and the substitution of a better class of oils as far as the consumption of the mills insured in the Mutuals may be taken as an indication.

It will be observed that the great saving in cost of oils mentioned above is, doubtless, but a fraction of the amount actually saved both to the mills and to the insurance companies by the use of safer oils. We publish Mr. Woodbury's paper entire, with the exception of two algebraic computations and some tables of tests of samples. The methods employed and results obtained are well shown in the paper as presented with the diagrams.

Single and Compound Engines.

Since the invention of the compound engine, there has been a difference of opinion between its friends and designers and those of the single engine. This difference is, however, growing less as improvements are made in compounding by which the true economy is made more apparent. The latter have claimed that the compound engine is not so economical, practically, as is apparent in a theoretical analysis of the diagrams taken from it, while the results of tests which have been made show that a well built and properly-proportioned single engine has developed an economy that has been equal to, and, in some exceptional cases, even greater than some compound engines.

The true and reliable evidence of the results accomplished by any engine is, after all, shown conclusively by the difference in the coal bills.

The advocates of the compound engine claim that using the steam twice, or, in other words, after it has been expanded in a high pressure cylinder, exhausting it into a low pressure cylinder, where it is again expanded, is a method by which the greatest amount of work is derived from the steam before it is finally condensed. By the introduction of a superheating coil between the two cylinders, it has been made to appear, by working up the diagrams taken from both cylinders, that there was more power developed than was first put into the engine by the steam.

In the present issue of the AMERICAN MACHINIST we publish the first part of a paper on the subject of high rates of expansion as applied to single and compound engines, by Mr. J. C. Hoadley, which was read during the late meeting of the American Society of Mechanical Engineers, held in this city. This paper begins in an elementary form with diagrams, illustrating the simplest type of single engine. Passing on step by step the author covers all the different stages of improvement through which the steam engine has passed, until the most improved form of compound engine is reached.

This paper will be fully appreciated by the engineering community, particularly as it comes from so eminent an authority and an engineer of such an extended practical, as well as theoretical, experience as Mr. Hoadley.

How to Restore American Ocean Commerce.

A recent issue of the *Western Manufacturer* contains the following:

Since the late Shipping Convention, held the early part of October, in Boston, there has been a deal of discussion as to the best means of infusing new life into our shipping interests. Some have approved and others have severely criticised the method recommended by the convention. The AMERICAN MACHINIST makes the following suggestions, which are certainly worthy of consideration:

"Enact a law, that, beginning, say two years after the date of its passage, the government, which is already in the business of providing mail facilities for its citizens, shall receive no proposals for rendering such services, either at home or abroad, from others than American built ships, and the problem is solved. Within that two years the skill and enterprise of American builders, and the cash of American capitalists, would give us a line of American steamers to every prominent port in the world, and the government would find itself, within a few years, in a position to receive competing bids for carrying the ocean mails from Boston, New York, Philadelphia, Baltimore, New Orleans and San Francisco Steamship Companies, at figures not greatly higher than it now pays to English, French and German companies for the same service. The tremendous impetus thus given to iron shipbuilding interests would inevitably redound to the advantage of those owners and builders of wooden ships who do not promptly take the hint, stop the futile attempt to fight the nineteenth century, and convert their yards into manufactories of iron vessels. The United States will not allow any man but a native-born citizen to be President. Why not also enact that the mails shall be carried only by vessels built and owned in America?"

Our suggestion quoted above has been urged by us upon two or three occasions, and at some length, the first of these occurring in our issue of July 31, 1880. The noteworthy circumstance to which we especially invite attention now, is the fact that an influential Western journal is disposed to receive such a proposition thus favorably. In the East or South, near the seaboard, such sentiments would be far less significant. If the West is ready for the proposed measure, surely the seaboard can afford not only to consider it seriously, but to work for the splendid results that would assuredly follow.

The Apprentice.

Many speculations have been made, from time to time, by persons who pretend to understand the subject, in regard to the proper system to be adopted for employing and governing apprentices.

If the ideas of some manufacturers were to be generally adopted the boys now in the country, who are desirous of learning a trade, would have a poor show indeed. Employers sometimes seem to forget that they were once boys themselves, and have little or no consideration, except to make money. We are acquainted with a number, however,

who have "laid themselves out for the boys," and are still making money.

The most enterprising firms in this direction have adopted a system for combining a study of the theory of the construction of machines with a practical experience of the same. When the enterprising youth, who has been less fortunate in getting a situation, reads of these advantages given gratis to apprentices in other shops, he becomes glum, and looks out upon the future as having little encouragement for him. He may be located in an out-of-the-way place, where there is no public library, or any facilities by which he can procure the right kind of practical and scientific information that will enable him to understand the true reasons for causes and effect in his business. Under these circumstances, what is the best course for the young man to adopt for advancement in a knowledge of his business? From our own experience, we would recommend, as a first step, to study mathematics. He should also study mechanical drawing, for no one who expects to fill an enviable position to-day would think of doing so without a knowledge of drawing. The advantages thus afforded are beyond computation. If the accommodations at the boarding house will not admit of a quiet evening study of about two hours, hunt another boarding house at once, for valuable time should not be wasted for any such excuse. Invest in a small stove and a few good books, as your means will admit, studying each carefully. A box of drawing instruments is indispensable. If you cannot afford to pay a teacher for instruction, pitch in yourself with a determination to succeed. It is up-hill work all the way, but it is wonderful what progress can be made without a teacher. We know an excellent mechanical draughtsman who never had an hour's instruction in drawing during his life. He bought a reliable book on the subject and worked until he succeeded. There are good books for self-instruction which may be easily procured. But the first point to be settled is whether such a course is desirable to the individual; if decided in the affirmative, then by backing it up with a firm determination, success is sure to crown such efforts.

Location of Cotton Mills.

According to advance sheets from the Census Bureau, there are 1,195 cotton mills in the United States, located in thirty States as follows: Alabama 19, Arkansas 2, Connecticut 117, Delaware 9, Florida 1, Georgia 51, Illinois 5, Indiana 4, Kentucky 5, Louisiana 2, Maine 28, Maryland 22, Massachusetts 247, Michigan 2, Minnesota 1, Mississippi 8, Missouri 5, New Hampshire 47, New Jersey 29, New York 72, North Carolina 53, Ohio 7, Pennsylvania 239, Rhode Island 142, South Carolina 20, Tennessee 32, Texas 5, Vermont 8, Virginia 10, and Wisconsin 3. The city of Philadelphia has 177 mills, Fall River 38, and Pawtucket 27. These figures represent the number of proprietors of establishments in each place, not the number of mill buildings.

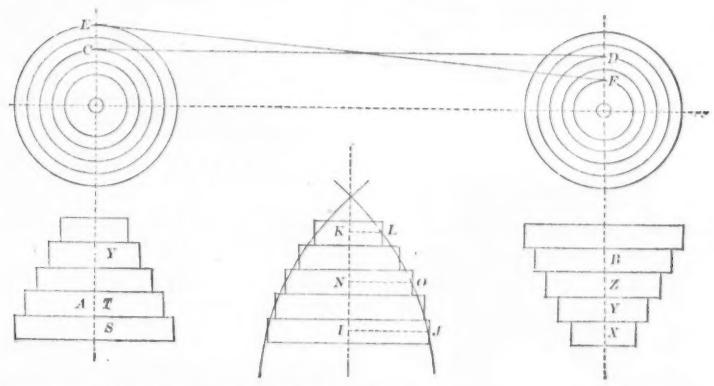
Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) E. G., Massillon, O., writes: I would be pleased to have you give me a little advice. I am a young man, a pattern maker—have worked at the trade 6 years—have had some little experience in draughting, but desire to perfect myself in it, as much as I can without any instructions, other than what I can gain from books. There is no mechanical draughtsman in this place. I can only devote my evenings to it. I would like you to refer me to the *best book* that is most suited to my case. *A.*—We have known young men to learn mechanical drawing without a teacher by a careful study of the Machinists and Engineers Drawing Book, By Blackie & Son. In addition to the above we would recommend that you procure a copy of Machine Construction and Drawing, By Tompkins, 2 vols. also Mathematical Drawing Instruments, By E. Hulme. These books are a great assistance to any young man who is desirous of learning mechanical drawing without a teacher.

(2) J. B. G., Chattanooga, Tenn. writes: I would like to ask two questions. 1st. Why will a belt run towards the ends of two lines of shafting that are nearest together? I had an argument with my employer; he claimed that the belt would run towards the other ends or those where the ends of shafts are farthest apart, as he thought there would be the highest points in the pulleys. *A.*—This question has been fully illustrated and described in an article on the Running Conditions of Belts, by L. F. Lyne, which appeared in our issue of April 17, 1880. 2nd. How can I lay out a cone pulley so that the belts will be of same tension on all the pulleys? I make the diameters of the pulleys on driving and driven shafts count the same. For example: I want to make a cone with largest pulley on the driving shaft 16″ diameter and the smallest pulley on driven cone 7″. These two diameters I add together making 23″. I now proceed desiring to make my next driving pulley 14″. This will make my next pulley on driven cone 9″ and so on. Is this correct? *A.*—Your reasoning is not correct. A similar question to this was answered in the AMERICAN MACHINIST, Nov. 15, 1879, also Nov. 20, 1880. "Another explanation" was given in an article on The Application and Power of belts, by V. Hook, Jan. 4, 1880. We here publish the whole subject in a condensed form which is taken verbatim from Cooper's Treatise on The Use of Belting:

When two cones of pulleys, or "stepped cones," are made alike—that is, with equal steps, such that the sum of the diameters of each belted pair is the same, a *crossed belt* will run with equal tension on any pair so made, when the shafts are parallel and the cones reversed; but an *uncrossed belt* will not so run on such cones. To show why the open belt will not have equal tension on all the pulleys, let *AB*, in the engraving, be two equal stepped cones on parallel axes *AE* and *BD*. Now if the sum of the diameters of the extreme pulleys *E* and *F* be equal to the sum of the diameters of *C* and *D*, the connecting strips *EF* and *CD* of the belt will be equal, because the enrolled parts are equal by the construction of the cones; but *EF* and *CD* cannot be equal, because they are not parallel, and hence it plainly appears that *CD*, being at right angles to the shafts, is shorter than *EF*; therefore, to preserve a certain tension of the belt when on the extreme pulleys, the middle pulleys must be larger than the size given by equal steps, in order to take up this difference. To find the proper diameters of the intermediate pulleys for open belt cones, first get, by Rankine's rule (annexed), the radius *NO* from the given radii *IJ*, *KL*, and distance between shafts, and through the points *JOL* describe a circle arc, upon which draw the faces of all the pulleys in the series as shown. Make both cones by this rule, and an open belt will run upon them with equal tension. Unequal cones may be made in like manner by drawing two similar cones, and then using, say, *STV* of the large end of one, and *XYZ* of the small end of the other, as nedeed to serve the purpose. For wheels driven by round bands in *V* grooves, the same rules apply, observing that the *effective* diameters must be taken at the line of *band contact* in the grooves, which are the acting circles of adhesion. All the grooves must be alike, and should have concave instead of straight sides, like a Gothic arch, and the band must not touch the bottom of the groove.



Rankine's Rule.—When the belt is uncrossed, use a pair of equal and similar conoids tapering opposite ways, and bulging in the middle, according to the following formula: Let c denote the distance between the axes of the conoids; r_1 the radius of the larger end of each; r_2 the radius of the smaller end; then the radius in the middle, r_0 is found as follows:

$$r_0 = \frac{r_1 + r_2}{2} + \frac{(r_1 - r_2)^2}{6.28\,c}$$

(3) F. S. Indianapolis, Ind., asks: What can I put upon a bright and burnished bicycle to best preserve the steel color during use? I am frequently compelled to neglect it after a wet run. *A.*—Prepare a lacquer from the following ingredients: Clear grains of mastic, 10 parts, camphor, 5 parts, sandarach, 15 parts and elemi, 5 parts. Dissolve these substances in a suitable quantity of pure alcohol, filter and apply without heat. This varnish is transparent and if the surface of the metal is properly cleaned and polished, the brilliancy of the metal will not be impaired.

Business Specials.

50 cts. a line for each insertion under this head.

C. Spiro, Counselor at Law and Mechanical Expert. Specialty, Infringement suits. 10 Spruce St., N. Y.

Presses and Dies. Ferracute Machine Co., Bridgeton, N. J.

Engine Castings. Complete set for 2 H. P. Engine, $15. W. M. Boyd, Box 793, Pittsburgh, Pa.

Parties having machinery to build by contract will do well to correspond with subscriber. Address, A. H., care of J. H. Parsons, 317 Broadway, New York.

Rules for Engineers, and Removal of Scale in Boilers. Send for Circular. Ranken Scale Co., 50 Federal Street, Boston.

Thomas D. Stetson, Patent Solicitor and Expert in Patent Cases, No. 23 Murray Street, New York.

Blowers for all purposes. Exeter Machine Works, 50 Federal Street, Boston.

See Standard Turbine advertisement in last issue.

We desire to correspond with persons having clean copies of the AMERICAN MACHINIST which they are willing to dispose of as follows: Vol. 1, Nos. 1, 2, 3, 9 and 11. Vol. 2, No. 2. American Machinist Publishing Co., 96 Fulton St., New York.

American Watch Tool Co., Waltham, Mass. Lathes, Watch Case, and Clock-Making Machinery.

James W. See, Designing and Consulting Engineer, Hamilton, Ohio.

Howard S. Abbot, Attorney at Law and Solicitor of Patents, 617 7th Street, N. W., Washington, D. C. Personal attention given to cases in Patent Office.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

John Douglass, common and fine patterns made to order, also car wheels, working models, and experimental machinery. Shop at 83 Morgan street, near Washington, Jersey City, N. J.

Paper Making Machinery—Makers of above from fibrous material as wood, esparto grass, etc., send address to Joshua Rose, P. O. Box 3306, N. Y. City.

"Monitor Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton St., New York.

MANUFACTURES.

The Straight-Line Engine Co., Syracuse, N. Y., have leased the property known as the Williams & Wallace Mower and Reaper Works, and have relet the foundry to the Smith & Wheeler Foundry Co. The buildings are being put in thorough repair, and both companies are putting in new machinery and tools. The Straight-Line Engine Co., have orders that will keep them driven, even with their facilities doubled, for two or three months to come.

D. Saunders' Sons, Yonkers, N. Y., have just sent an eight-inch pipe-cutting and threading machine to W. C. Allison & Co., Philadelphia.

The Cope & Maxwell M'f'g Co., Hamilton, Ohio, have recently shipped to Atchison, Kansas, for the water works of that city, two vertical direct-acting plunger pumping engines, fitted with their patent "Isochronal," or self-governing, valve gear. The steam cylinders are twenty-four (24) inches diameter, by thirty-six (36) inches stroke. The pump plungers are fourteen (14) inches diameter by thirty-six (36) inches stroke, arranged so they can be packed from the outside, thus specially adapting them for pumping the muddy water of the Missouri river. The steam cylinders are placed twenty-two (22) feet above the pumps, and their respective bed plates are connected by three (3) large cast iron columns, the whole structure weighing over forty (40) tons. They are very busy upon their regular stock sizes of pumps, besides filling orders for special work, and find it necessary to be adding new tools and appliances, as well as workmen, continually.

The Continental Iron Works of Greenpoint, N. Y., are having a large steam blast nozzle made to be used to increase the draught in a smoke stack, six feet diam., on board a U. S. steamer. This blast nozzle is furnished by A. Aller, 109 Liberty Street, New York, and will take the place of a steam jet formerly used.

We learn that J. A. Fay & Co., of Cincinnati, Ohio, manufacturers of wood-working machinery, are overwhelmed with orders, and although their facilities have been largely increased, and they have been running their factory day and night for some time, are unable to keep up with the demand. They are now constructing heavy machinery for a number of large railroads and car shops. Among them are two outfits for the Union Pacific Railway, the order for which was the largest ever given by any one party for wood-working machinery of one manufacturer. The Pullman Palace Car Co., the Pennsylvania R. R. Co., Atchison, Topeka and Santa Fe R. R. Co., the Grand Trunk R. R. of Canada, and many others, have recently been furnished with new and improved machinery for manufacturing their cars, from this well known and enterprising firm.

Pitkin Bros., Hartford, Conn., boiler makers, have finished and are getting out 10×80 H.P. boilers, for the extension of the Pocasset M'f'g Co.'s cotton factory, Fall River, Mass.; one 80 H.P. boiler for Mower & Arms', paper makers, Bellows Falls, Vt.; two 50 H.P. for East Hartford M'f'g Co.; one 75 H.P. for Hanmer & Forbes Co., East Hartford, and nine large boilers for the Hartford Steam Co.

The Westmoreland Hotel, Fourth Avenue and Seventeenth Street, has lately put in a steam blast nozzle to increase the draught in their chimney, furnished by A. Aller, 109 Liberty Street, New York.

The Dover Iron Company, Dover, N. J., are now putting in several large universal duplex injectors to feed their steam boilers, dispensing with steam pumps altogether.

The Waterbury (Conn.) Watch Co. have completed their new works. The main building is 64 feet square and four stories high. There is one wing of 140×30 feet, three stories. Power is furnished by a 35 H. P. Wheelock Steam Engine. The works are calculated to make 1,000 watches a day. This factory was planned, erected and equipped by Mr. Ambrose Wester of the American Watch Tool Co., Waltham, Mass.

In a little more than two years the United Workingmen of California have paid to the heirs of their deceased brothers the handsome sum of $214,000. That is a record to be proud of.

O. A. Pray & Co., Minneapolis, Minn., are full of orders fitting out several new mills. They are deserving of success, as they have shown a progressive movement in putting in the latest and most improved tools the market affords.

The Leetonia (O.) Tool Works are pressed with orders, and are enlarging their capacity.

The Klemm Telephone Company, New York, has been incorporated by Julius Kayser, Marcus Marx, and others. Capital, $1,000,000, in shares of $50 each. For the manufacture and sale of telephones and telephone transmitters, and the sale of rights to use the same in the Dominion of Canada, under patents of Klemm and Tisdal.

The National Spring and Journal Box Company, New York, has been incorporated by Charles H. Todd, James Plant, and others, Capital, $600,000, in shares of $100 each. For the manufacture and sale of railroad car and carriage springs, and railroad journal boxes.

New York Machine Ornamenting Company, New York, has been incorporated by John Q. Hoyt, John D. Snedeker, and others. Capital, $300,000, in shares of $25 each. For the manufacture and sale of ornamental designs and decorations on wood or other materials, for buildings, furniture, cars, carriages, musical instruments, fancy articles, etc., under patents of John P. Jameson of Cambridge, Mass.

The National Machine Co., Troy, N. Y. has been incorporated by Shepard Tappen, John M. House, and Edward O. House, Capital, $75,000, in shares of $100 each. For the manufacture and sale of button-hole machines and attachments, and sewing machine attachments.

The Perry Royce Reaper Works Co., of Wyoming County, N. Y., are arranging for the manufacture the coming season of 3,000 machines, representing a net value of $400,000, and employing a force of 125 men in their construction.

Machinists' and Engineers' Supplies.

NEW YORK, November 25, 1880.

Since the commencement of the cold period business in some branches of supplies seems to have fallen off a little, but such an event may reasonably be expected as the Holidays draw near.

There is still a dearth of new inventions, and dealers are still exerting themselves to supply their orders. Manufactured articles are, however, more easily obtained than when last reported.

There is a scarcity in the market of 5 ft. engine lathes.

Kelley & Ludwig, of Philadelphia, Penn., have opened an office for the sale of the Strong Feed Water Heater at 6 Cortlandt St., New York. The office is in charge of Wm. H. Hoffman.

Iron Review.

NEW YORK, November 25, 1880.

There is little that resembles activity in the iron market this week although it is rumored that there has been a slight advance in prices. We have found no evidence to prove this however and continue to quote as follows: Foundry No. 1, $25@26. Foundry, No. 2, $21, and Gray Forge $20. Mr. Chas. G. Lundell, of 7 Exchange Place, Boston, Mass., has just received a cable dispatch from Gothenburg, Sweden, which states that the price of charcoal iron is on the increase, which fact will probably have the tendency to further advance the Swedish iron market over the decided stiffening that has been going on for two weeks past.

The trade in manufactured iron is fair but not brisk. Prices are unchanged and we continue to quote the following prices:

American Iron Rails, $50 to $53, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 3¼c.; Bolts and Nuts, 3½c.; Common Bar Iron, 2.4c., basis from store, Refined do. 2.6c., basis; Ulster, 3 6-10 basis; Machinery Steel, 6¼c.; Best Tool Steel, 13¼c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 6¾c.; Sheet Iron, 3½c., basis; Angle Iron, 3¼c.; Tee Iron, 3¾c.; Band Iron, 3 2-10c.; Hoop Iron, 3.6c., and up according to size; Horse Shoe Iron, 3 2-10c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies from store as follows:

Flange Iron	5¼
C. H., No. 1, Shell Iron	4¼
C. No. 1 Iron	4
Tank Iron	3¾
Sheet Iron	3½
Angle Iron	3½
Bead Iron	5½
Burden Boiler Rivets	5 1-10

Boiler Tubes at 40 per cent. discount off list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of Nov. 24, 1880:

Business only moderatively active, prices very firm. Pig Tin, in London, £93 10s.; Singapore, $29. No stocks offering. We quote the nominal stock market: Banca Tin, 25c.; Straits and Malacca, 21¾ to 22c.; Australian and Billiton 21¼ to 21½c.; "Lamb & Flag," 21c.; Bar Tin, 22c. and upwards, as to quality. Lead, 5c.; Antimony, 16 to 16½c. for Cookson; 15¼ to 15½c. for other brands; Spelter, 5¼ to 5½c. for Domestic, and 8½c., "Bertha," pure; Solder, No. 1, 11½c.; "Half and Half," 13½c.; Bismuth, $2.50 to $3.00.

WANTED.

Parties desiring a competent man to superintend the erection of engines or machinery, address J. F. Kingsley, Box 777, Owego, Tioga Co., N. Y.

By a Mechanical Engineer well known professionally, thoroughly capable in practical shop details, designing and draughting. The best references to character and ability. Address, H. K, 34 Park Row, Room 33.

A. ALEX. POOL & CO.

NEWARK, N. J.
Manufacturers of
Combined Lathes and Milling Machines
FOR TOOL MAKERS' USE, also
Universal Milling Machines, Grinding Machines.

CARMICHAEL & EMMENS,

130, 132 & 134 Cedar Street, New York.
DEALERS IN
Iron and Steel Boiler Plate,
LAP WELDED BOILER TUBES, &c., &c.
Agent for Otis Celebrated Cast Steel Boiler Plates; the Coatesville Iron Co.; Pottstown Iron Co.; the Laurel Rolling Mills and Union Tube Works.
Wrought Iron Beams, Angles, Tees, Rivets, &c.

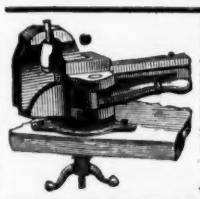
USEFUL BOOKS

Relating to Casting and Founding, Electricity, Electric Light, Engineering, Drawing, Manufacture of Gas, Heat, Indicator Diagram, Link Motion, Mechanics, Screw Cutting, Slide Valve, Steam Boilers, Steam Engines, Steel, Turning, Wire Gauge, Workshop Receipts. Descriptive Catalogue sent promptly on application.
E. & F. N. Spon, 446 Broome St., N. Y.

GEO. W. FIFIELD,
Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application.
LOWELL, MASS., U. S. A.

Monitor Binders FOR THE American Machinist,

$1.00 EACH BY MAIL OR EXPRESS.

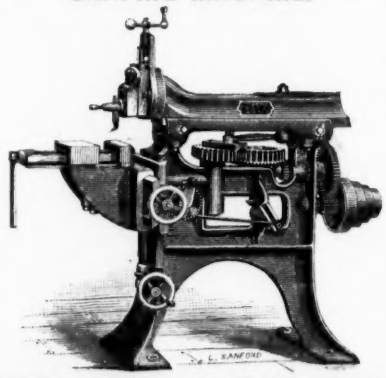


STEPHENS' PATENT PARALLEL VISE and attachments, adapted to every variety of work from Jewelers' to Locomotive Shops. It opens **further,** holds **firmer,** is **heavier** and more **durable** than any other vise. For sale by the trade.
Stephens' Patent Vise Co.
41 Dey St., New York, U. S. A

BARGAINS IN VERTICAL ENGINES,

The best made. 2½ to 15 horse power. Write for full particulars to WILLIAM COOKE, 6 Cortlandt St., New York.

SHAPING MACHINE.



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NEWARK, N. J.
Manufacturers of the new
Patent High Speed Allen Engine,
Planers, Lathes, Gear Cutters, Shapers, Slotters, Drill Presses,
Both double and single column, Bolt and Pipe Cutters, Keyseating Machines, Hydraulic and Sugar Estate Machinery, Shafting and Gearing, Boilers, &c. Heavy Hydraulic Oil Presses a specialty.

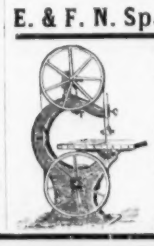
Corliss Engine and Allied Steam Motors

Working with or without Automatic Variable Expansion Gear, including the most approved designs of all countries, with special reference to the Steam Engines of the Paris International Exhibition of 1878. Translated from the German of W. H. Uhland by A. Tolhausen, C. E.

In two vols., 4to, with numerous illustrations, and an Atlas of 60 photo-lithographed working Drawings (16 in. x 22 in.) In paper, $32.00.

Our descriptive catalogue of books for mechanical engineers and list of machine drawing copies sent free by mail on application.

E. & F. N. Spon, 446 Broome St., N. Y.



Patent Band Saws,

A SPECIALTY.
Pattern makers are now using Band Saws exclusively for both inside and outside sawing because it *pays.* For circulars, address
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122 Mill Street, Rochester, N. Y.

Branch Office,
46 & 48 WEST LAKE STREET, CHICAGO, ILL.

BRADLEY'S CUSHIONED HELVE HAMMER.

Awarded first premium, Silver Medal at American Institute Fair, 1873, Cincinnati Industrial Exposition, 1874, and the Diploma of Honor and Grand Medal of Merit at the Centennial Exhibition, in 1876,
Being the highest award given any goods of their class in America or Europe.
IT HAS MORE GOOD POINTS, LESS COMPLICATION,
MORE ADAPTABILITY, LARGER CAPACITY,
DOES MORE AND BETTER WORK, TAKES LESS POWER,
COSTS LESS FOR REPAIRS
THAN ANY HAMMER IN THE WORLD.
Guaranteed as represented. (Established 1832.)
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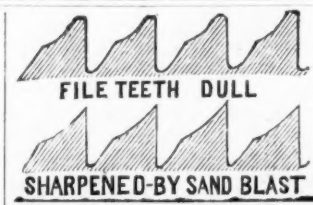

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SIMPLE, INEXPENSIVE AND EFFECTIVE.

Files are sharpened in a few minutes without drawing or disturbing the temper.

The teeth are made sharp and in the best shape for cutting without breaking.

Practical experience shows an *immense saving in Files* and *great increase in work* by always having them sharp. For shop rights, in country south and west of New York State, and for further information, address
Sand Blast File Sharpening Co., Wilmington, Del.

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Sole Manufacturers of
MORSE PATENT STRAIGHT-LIP INCREASE TWIST DRILL,

Beach's Patent Self-Centering Chuck, Solid & Shell Reamers.
BIT STOCK DRILLS,
Drills for Coes, Worcester, Hunter and other Hand Drill Presses. Beach's Patent Self-Centering Chucks Center and Adjustable Drill Chucks, Solid and Shell Reamers, Drill Grinding Machines, Taper Reamers, Milling Cutters, and Special Tools to order.
All Tools Exact to Witworth Standard Gauges.
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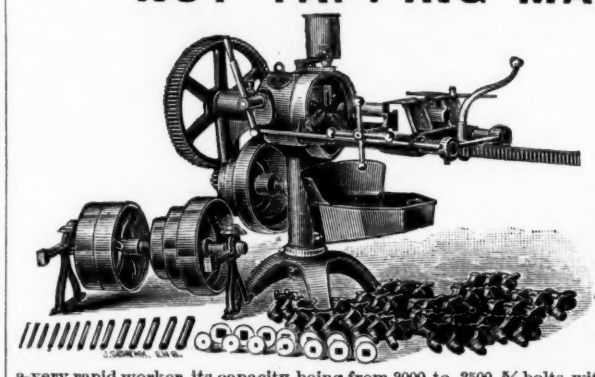
MANUFACTURERS OF
Schlenker's Revolving-Die Bolt Cutter
AND
NUT TAPPING MACHINE.



OUR NEW REVOLVING-DIE MACHINE is now recognized by practical machinists to be the perfection of a Screw Cutting Machine, and we now challenge the world to produce its equal. It possesses many advantages over any competitor. The dies are opened automatically when the desired length of thread has been cut on the bolt, and are closed by the lever, or automatically, as shown in the cut of the machine. It can be changed from one size to another in less than a minute without removing a bolt or pin. It does not require skilled labor, but can be operated by any competent boy. The dies are arranged to open and close automatically, therefore do not require the constant attention of the operator. It is a very rapid worker, its capacity being from 3000 to 3500 ⅝ bolts with 1⅜ inches of thread per day—and larger bolts in proportion. Threads cut by these machines will not vary ½ thread in length on ten thousand bolts. The machines are simple in construction, very compact and strongly built, and are offered much below the price of any other machines capable of cutting the same sizes, and amount of work. It is adapted to cut right and left hand, V thread, square threads, and coach screws,—will take in crooked as well as straight work, and cut any length of bolt. The machines are now largely in use, and we offer them to the trade as one of the most complete machinists' tools in the market. Every machine is warranted as recommended.

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Illustrated Catalogue sent on Application.

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Office, No. 78 Chambers Street, N. Y. — Full Weight Hand-Cut Files. — Manufactory, PATERSON, N. J.

The best and cheapest in the end. Send for quotations. The files speak for themselves in the following testimonials. Read them.

THE SINGER MANUFACTURING CO.
Messrs. KEARNEY & FOOT, Elizabethport, N. J., July 9th, 1877.
Dear Sirs:—We have for the past ten years used the Files of your manufacture, and during that time we have never had any fault to find with them. We can safely affirm that for evenness of temper, sharpness of cut, accuracy of shape and all other qualities which go to make up a perfect File. They are equal, and in some respects superior, to the best English-made Files. Very Truly, WM. H. INSLEE, Contractor.

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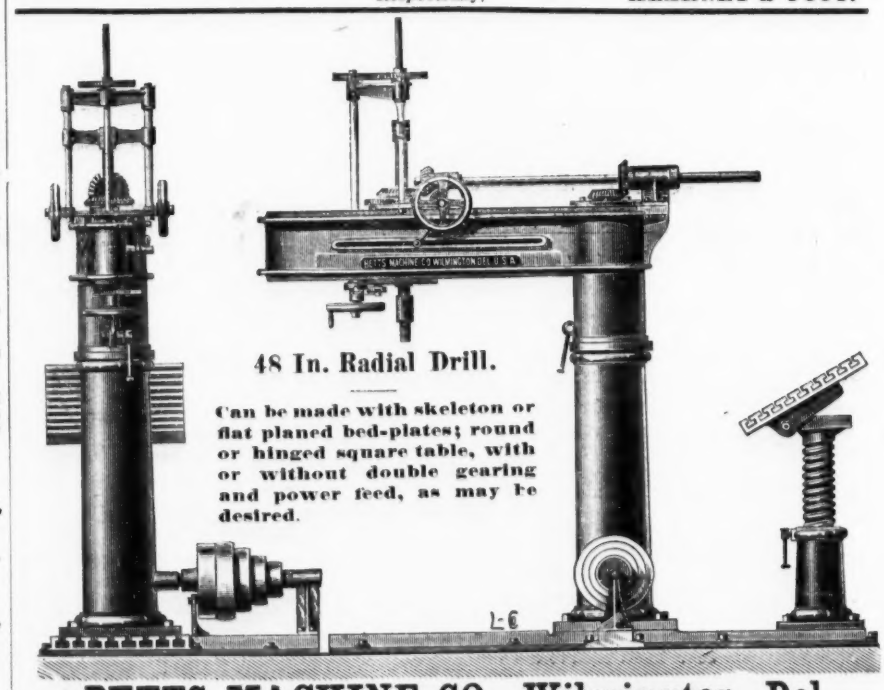
Gentlemen:—We have been using your Files, both new and re-cut, for several years, and take pleasure in saying that we have found them a very superior article.
HANS REISE, Contractor, with The Singer M'f'g Co.

We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.
Respectfully, KEARNEY & FOOT.



48 In. Radial Drill.

Can be made with skeleton or flat planed bed-plates; round or hinged square table, with or without double gearing and power feed, as may be desired.

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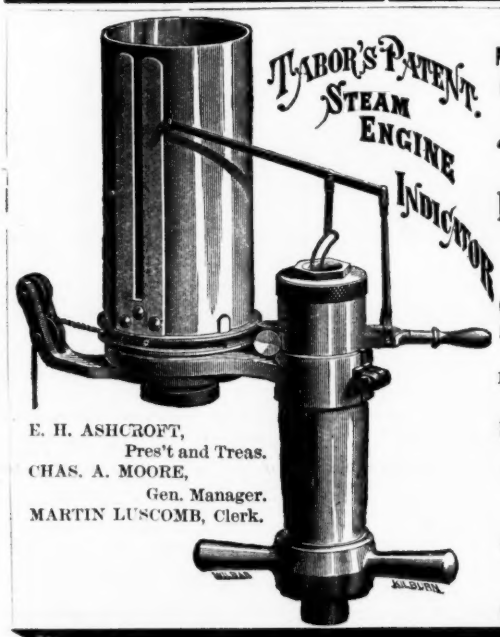

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With perfect, seamless thread, and hard wearing surface. Special mixture of tough iron. Superior to wrought iron in many respects, and **much cheaper.**

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Patent Hot Polished Shafting.

This shafting commends itself to the trade generally as superior to any shafting ever before introduced to the market for the following reasons, viz.:

1st.—It is perfectly straight and round.

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3d.—It has the beautiful blue finish of Russia Sheet Iron, rendering it less liable to rust or tarnish than shafting of the ordinary finish.

4th.—It will NOT SPRING OR WARP IN KEY SEATING like most of the other manufactured shafting sold in the market, and, as a consequence, is admirably adapted for LINE AND COUNTER SHAFTING.

5th.—The surface is composed of MAGNETIC OXIDE OF IRON, forming a superior journal or bearing surface.

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Sizes made from ¾ inch to 3 inches, advancing by sixteenths, and from 3 inches to 4 inches, advancing by eighths. Price lists, with references and other information, furnished on application to us.

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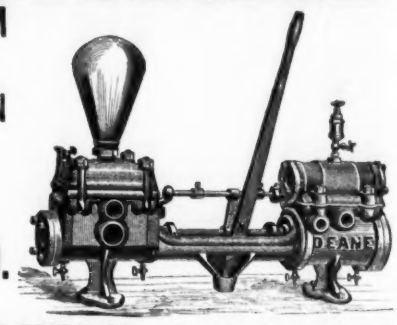
FOR SIMPLICITY OF MECHANISM
—AND—
EFFICIENCY IN OPERATION

THEY ARE UNEQUALED.



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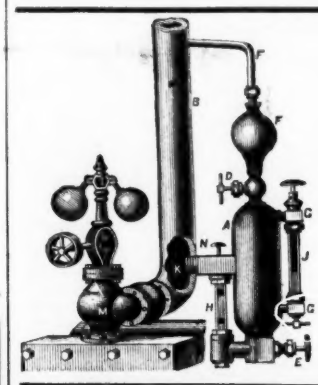

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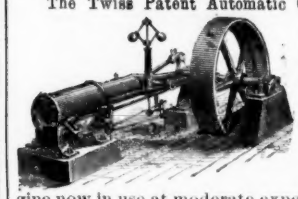
Illustrated Catalogue and Price List on application.

The Twiss Patent Automatic Cut-off Engine



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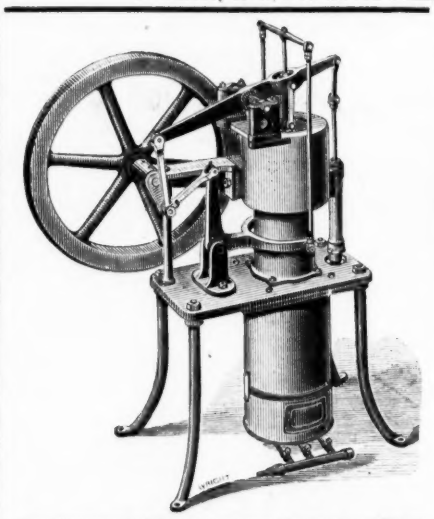

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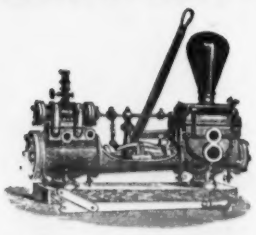

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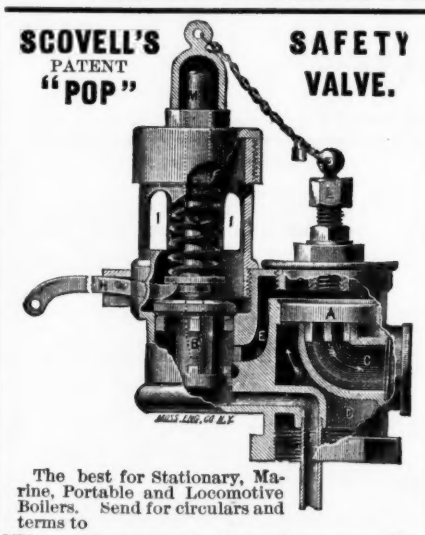

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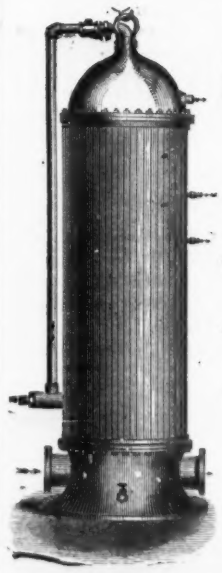

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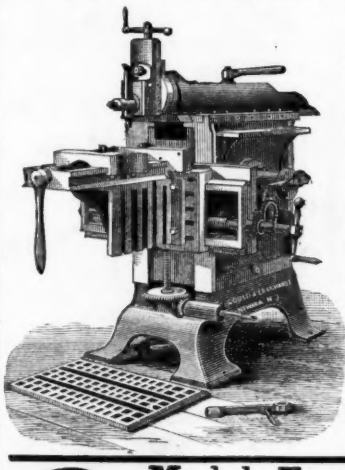

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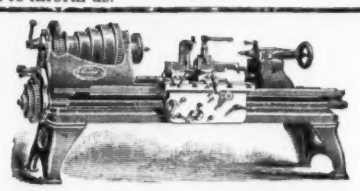

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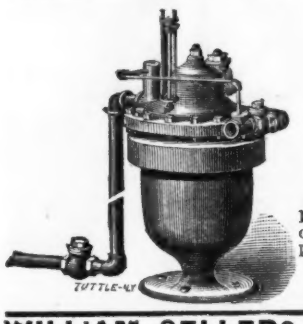

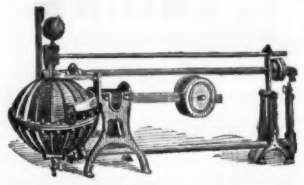

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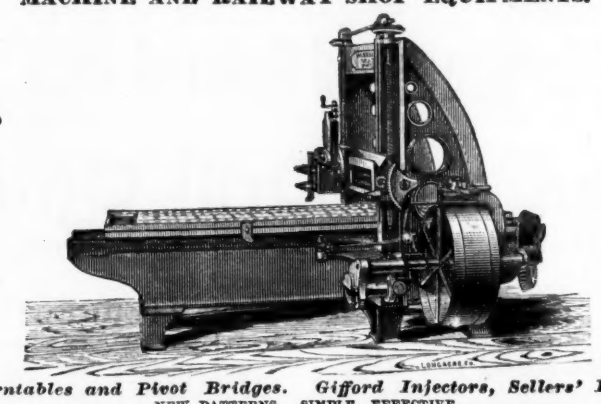

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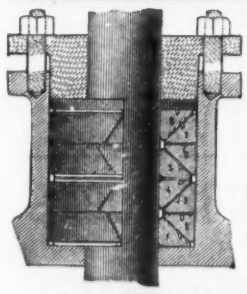

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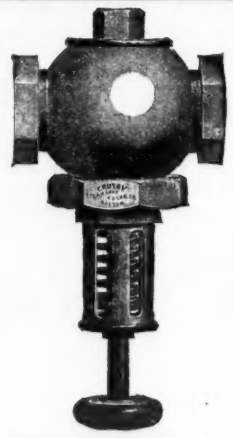

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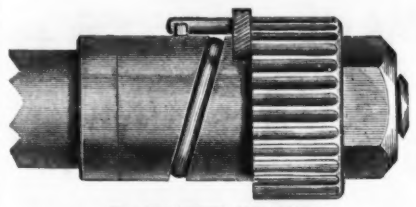

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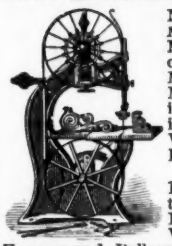

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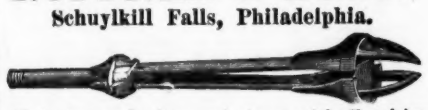

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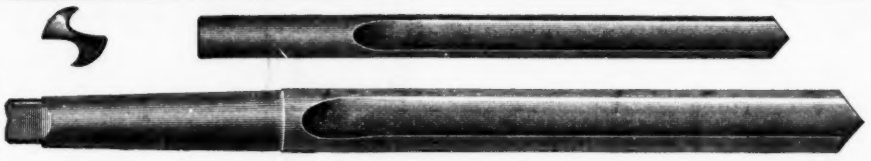

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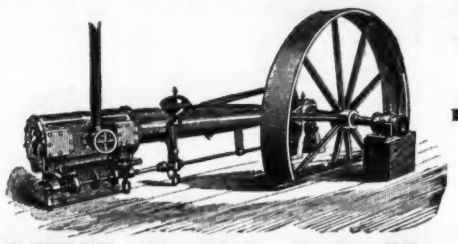

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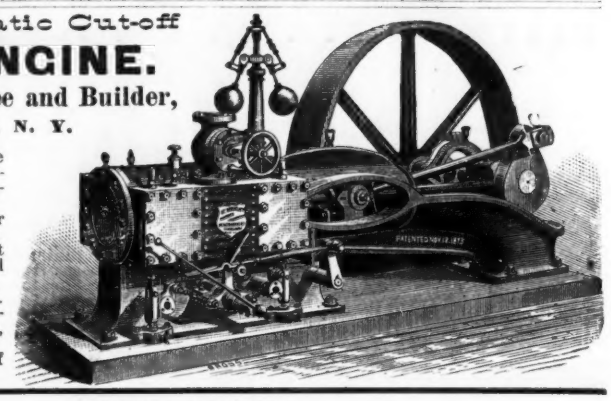

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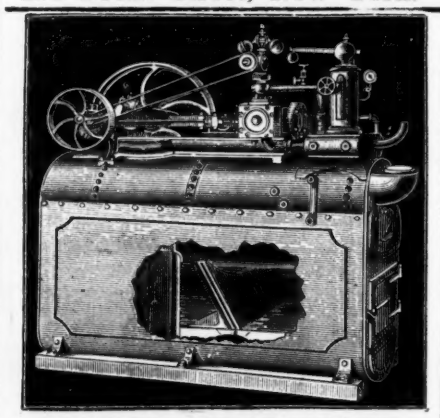

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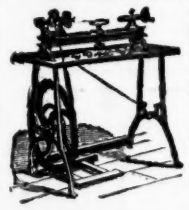

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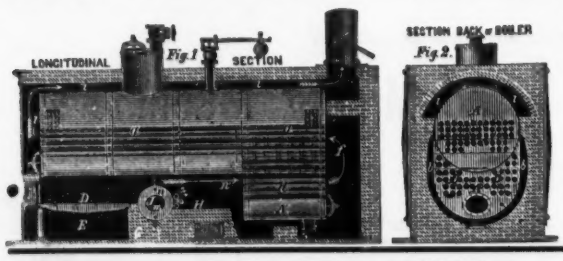

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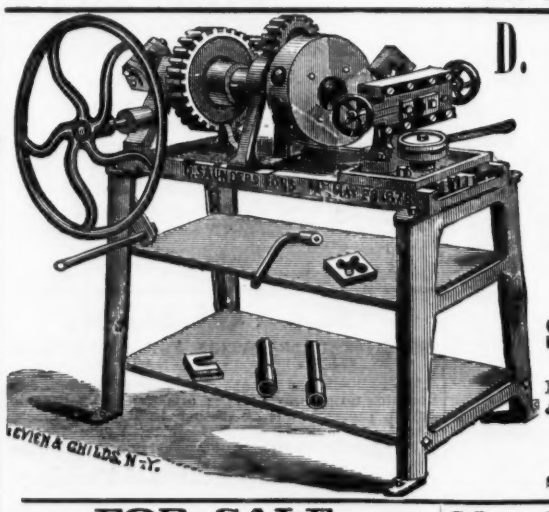

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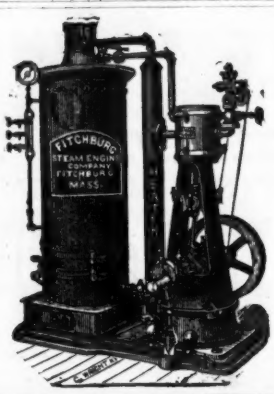

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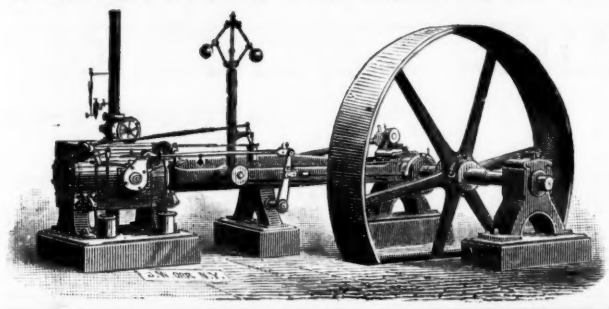

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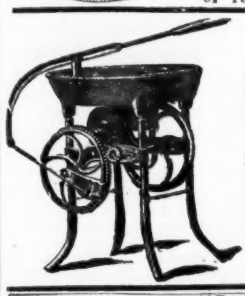

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One	" "	24 in. x 12 ft.	Ames.	New.
One	" "	24 in. x 10 ft.	"	"
One	" "	20 in. x 8 ft.	"	"
Two	" "	20 in. x 8 ft.	Fifield.	New.
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Four	" "			
One	Planer, 27 in. x 4 ft.	Windsor.		
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One	" 24 in. x 6 ft.	Ames.	New.	
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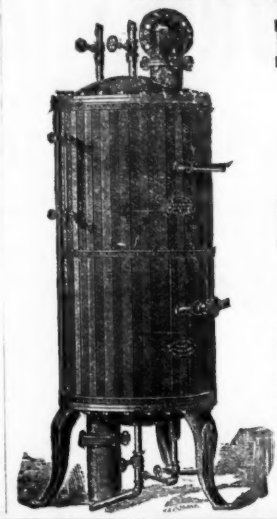

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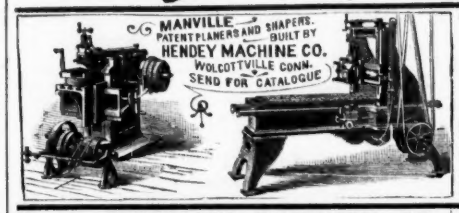

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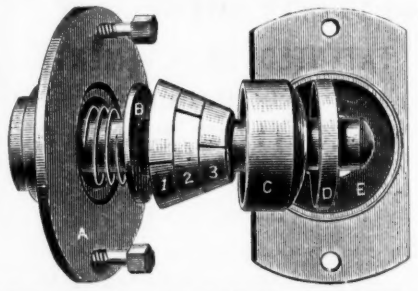

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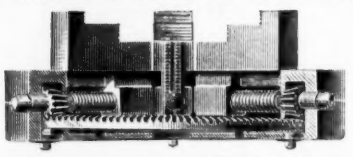

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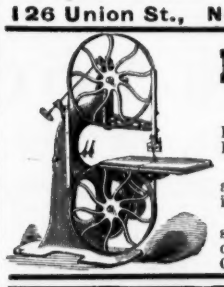

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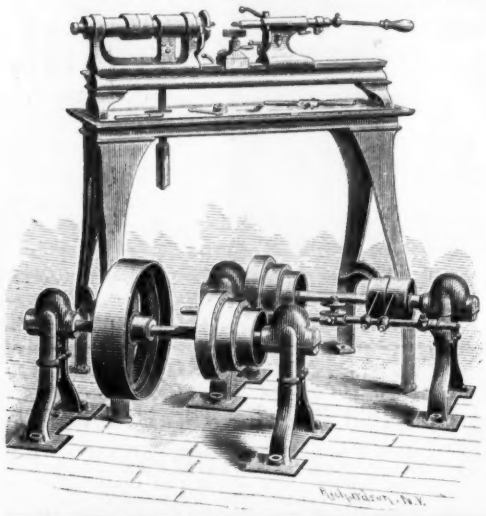

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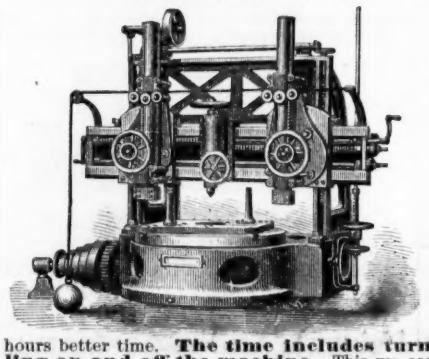

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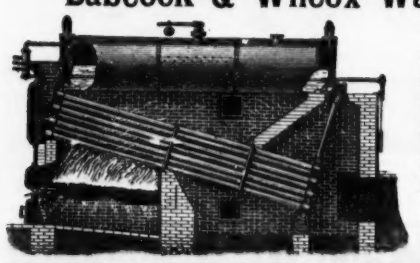

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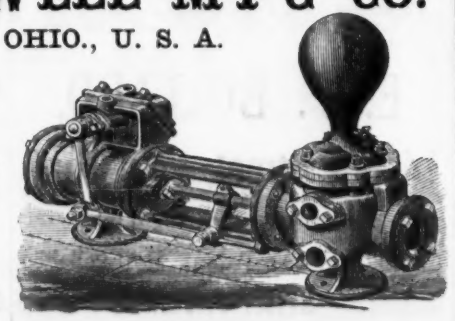

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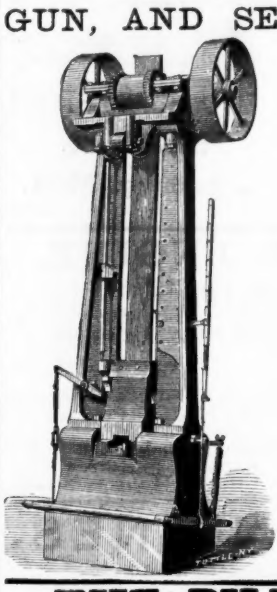

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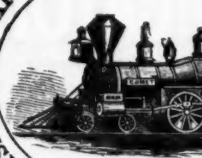

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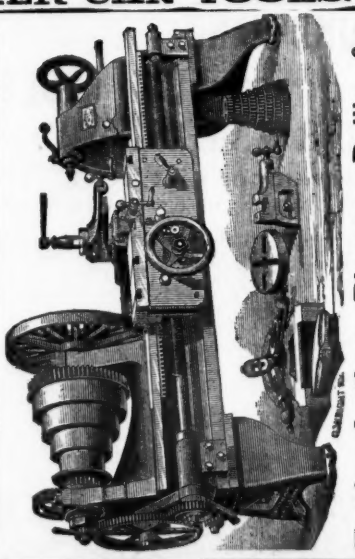

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